THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

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PC MAGAZINE

STARTING THIS ISSUE:
PC AFTER HOURS, THE LEISURE SIDE OF PERSONAL COMPUTING

VOLUME 6 NUMBER 13
JULY 21, 1987

ENT GUIDE TO NEW PERSONAL COMPUTING STANDARDS

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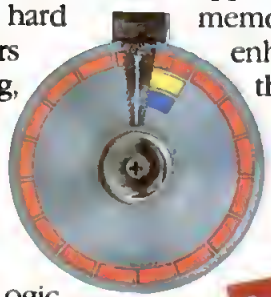

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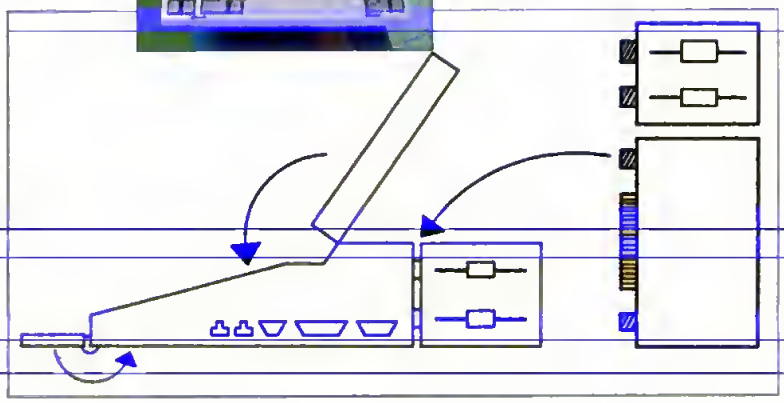

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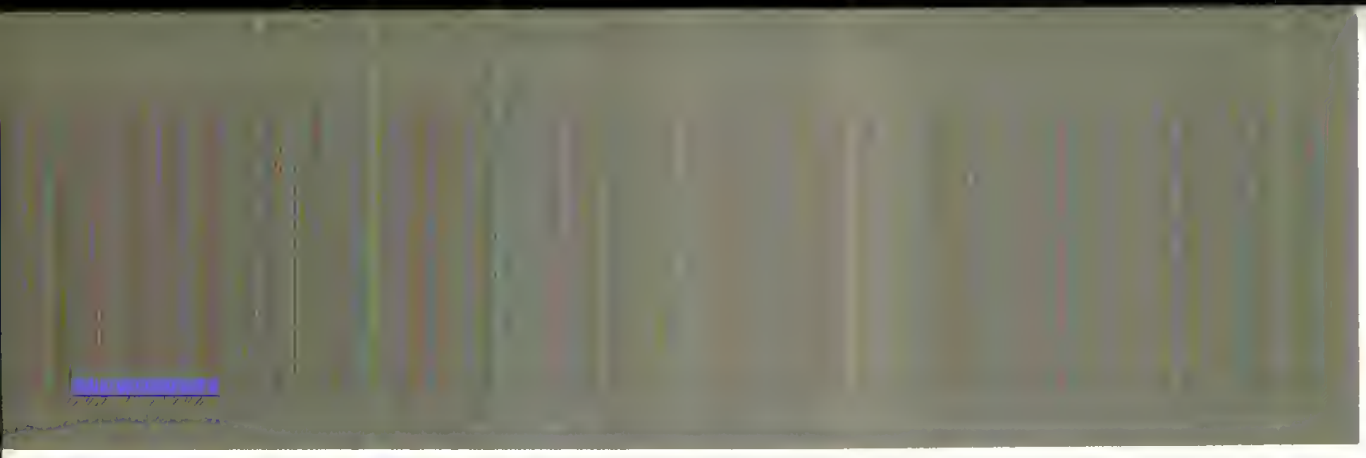

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Keeping us covered, coming and going, senior editor Gus Venditto

To the average person, "late closing" means you can still pick up your dry cleaning after you get home from work. On a magazine, it identifies a section with a later deadline than the rest. The First Looks section closes late so that we can bring you hands-on reviews of important new hardware and software only weeks after they've been released. Long after the rest of the magazine has closed, senior editor Gus Venditto and his staff are still working feverishly to get up-to-the-minute coverage of brand-new products into First Looks.

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Four Most

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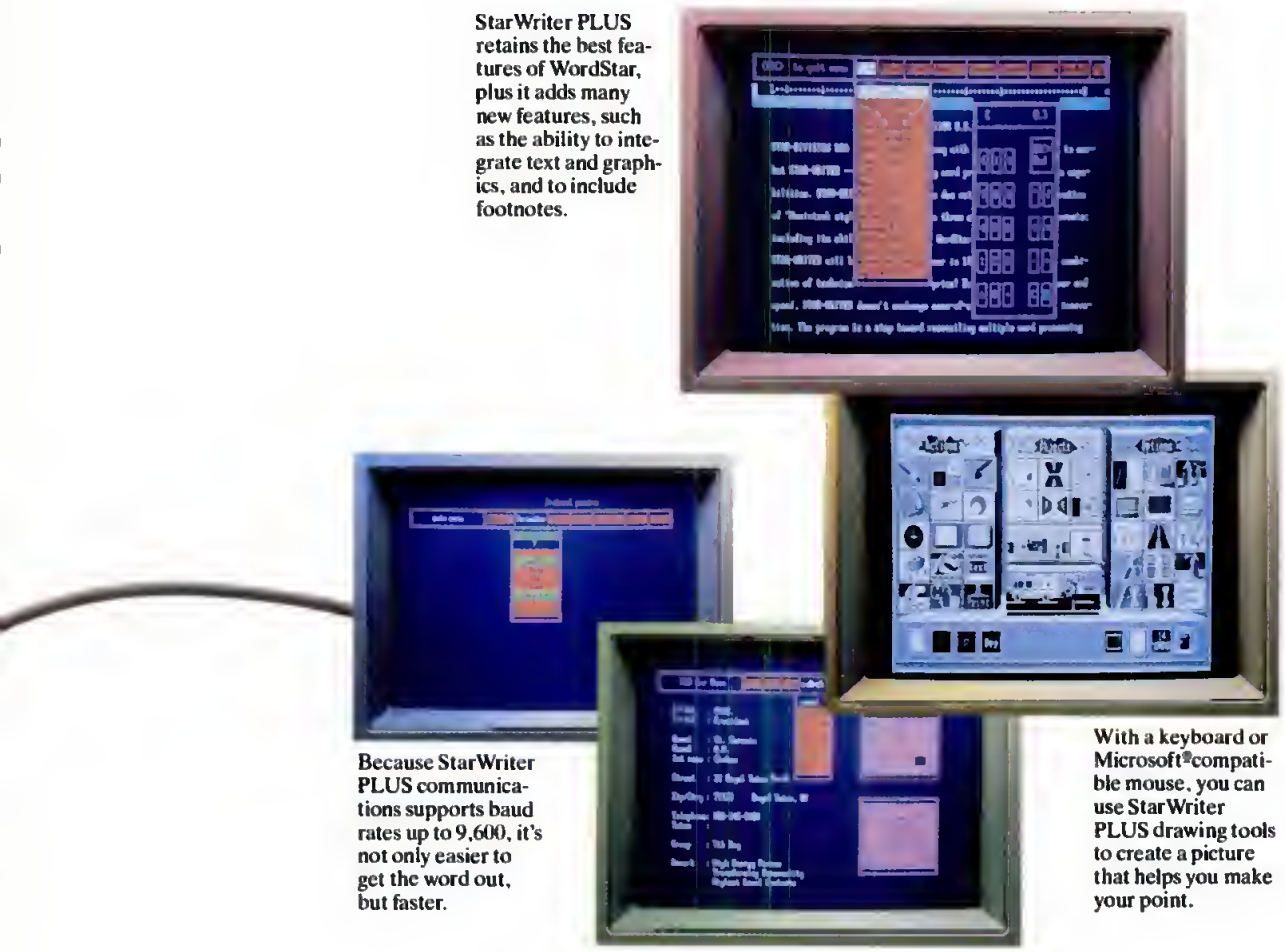

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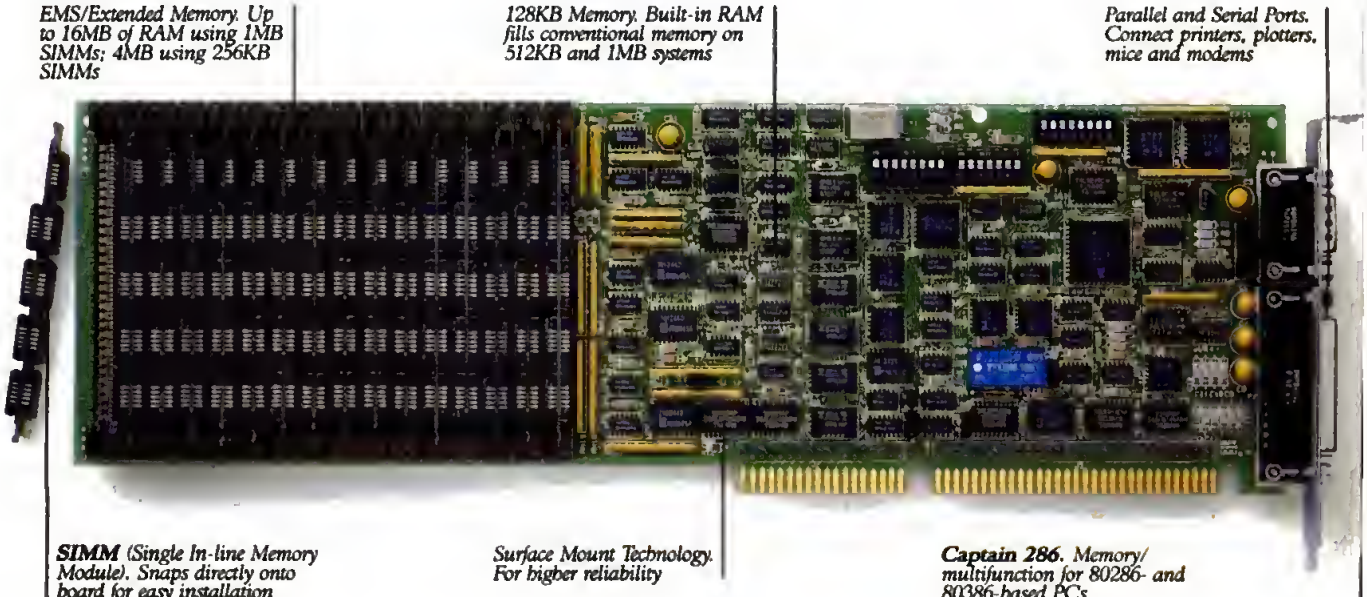

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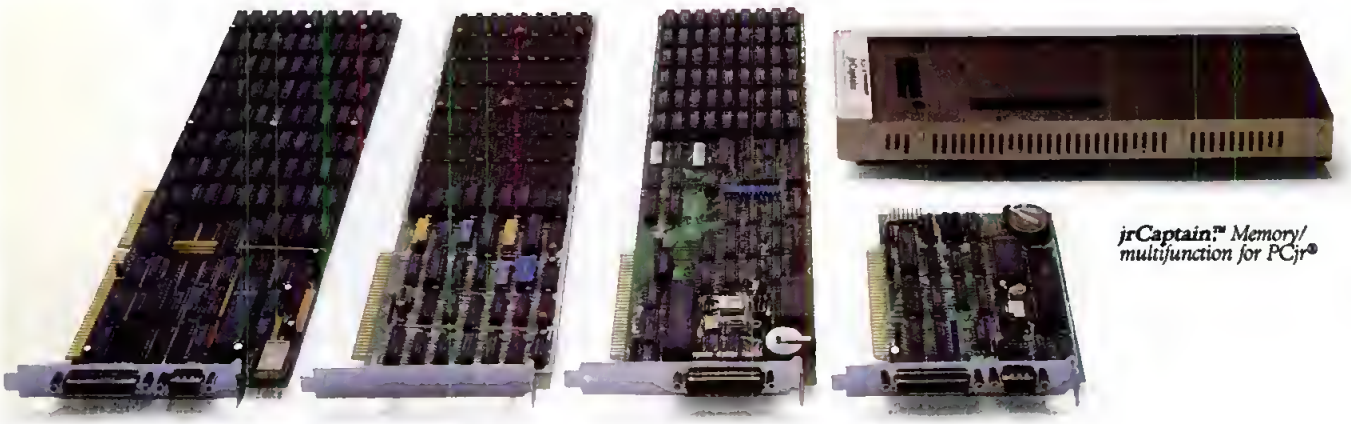

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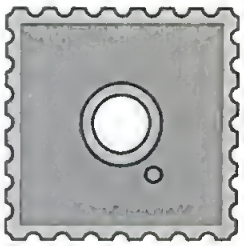
CIRCLE 364 ON READER SERVICE CARD

LETTERS TO PC MAGAZINE



COLUMNIST COMMENTS

Someday I'm sure I will get through a complete John C. Dvorak column. I've never managed that feat yet because there is just something about it . . . .

Robert A. Deckert
Palm City, Florida

There are not many columnists that I know by name. In fact, there is only one: Peter Norton.

I've been reading your magazine since Volume 1 Number 2, so I have seen how much it has grown and developed. Peter Norton was one of those developments. His column became the first thing that I read every issue.

I, like many of your readers, will miss his guidance and insight. You may find a substitute author for him, but he will never be replaced. Thank you, Peter.

Thomas Hurd
Buffalo, New York

Peter is a great guy. We sure will miss him too.—Ed.

ONCE BITTEN

I just wanted to tell you how much I enjoy your magazine. I used to read *BYTE*, but I have found that I understand *PC Magazine*'s articles a "bit" better.

David Stopher
Washington, D.C.

QUITE EFFECTIVE

At first glimpse of Mitt Jones's article on *PicturePower* (First Looks, page 46, *PC Magazine*, Volume 6 Number 6), it appears that this is another high-tech program that only computer maniacs can understand. However, the article shows that this product is really quite tame. In fact, after reading the article, *PicturePower* becomes something very appealing to almost everybody.

It is true that computers are very technical, but Mr. Jones has put some of this complex technicality into plain, simple words. He writes for a general audience, but in a way that people with minimal as well as vast computer knowledge can easily understand. In sum, Mr. Jones's article is very effective, in both style and content.

Edward M. Renner
Springfield, Virginia

HIDDEN IDENTITY

I was very interested in reading your article on multiscan monitors ("Behind the Screens: EGA and Multiscan Monitors," *PC Magazine*, Volume 6 Number 6). Since your Editor's Choice went to the NEC MultiSync and the JVC GD-H3214, I decided to compare for myself before plunking down the green.

After calling JVC to get the name of a local dealer that carried the monitor, I was told it does not sell to individuals or dealers—it only deals with vendors. It also gave no indication as to how one would go about getting the monitor (short of buying an entire system packaged with it).

I guess I may be stuck with the NEC unit, even though it may not be the best available today!

Steven J. Finnegan
Poway, California

You are correct. Unknown to PC Magazine *at the time of the review, JVC decided to sell the monitor only to vendors. However, the monitor is available under a different label (JVC will not reveal the name). If you look carefully at the other monitors in the review, you will notice that the Taxan Super Vision 770 bears a remarkable resemblance to the JVC GD-H3214.—Ed.*

TURBO DATING

The Turbo Dating routine described in your April 14 issue (Turbo Power User, *PC Magazine*, Volume 6 Number 7) was interesting because of the compactness of the implementation. However, the claim that it can return the day of the week for dates as far back as 1600 may be misleading to some of your readers.

The Gregorian calendar, the one we use today, was devised by Pope Gregory XIII in 1582, but was not in general use until the early 1700s. It was adopted for use in Great Britain and the American colonies in 1752. This act created an 11-day gap in American and British history in March of that year. Therefore, the results are likely to be unreliable for dates before 1752.

Edward Jackson
Sunnyvale, California

True enough. In fact, back when the 11 days vanished, peasants rioted in the streets to protest the extra rent they would have to pay.—Ed.

MANUSCRIPT: SOMETHING SLOW

Jim Seymour's column, "Manuscript: Something Old, Something New" (Jim Seymour, *PC Magazine*, Volume 6 Number 3), coupled with the advertising blitz on *Manuscript*, convinced me that the program was genuinely a scientific word processor. However, the program is seriously flawed. In fact, a better title for the article

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PC-JULY 87

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■ LETTERS

would have been "Manuscript: Something Old, Something New, Something Slow."

On my IBM PC AT, it takes more than 15 minutes to print a four-page document containing 15 to 20 equations. However, a more serious flaw is that *Manuscript* cannot properly handle equations mixed in with text. Text equations are printed noticeably smaller than the rest of the text. Until this flaw is fixed, *Manuscript* is not a viable word processor for scientific and technical users. I can only hope that Lotus corrects these problems in its next release.

Otis M. Solomon, Jr.
Albuquerque, New Mexico

MANUSCRIPT: SOMETHING GOOD

The review of Lotus's *Manuscript* by Robin Raskin and Kaare Christian ("Manuscript: A Technical Writer's Tool Kit," *PC Magazine*, Volume 6 Number 7) asked if anyone was ready to jump on the bandwagon. Within a week of receiving the evaluation copy, I bought it for my business use, and within a few weeks after that, I bought another copy for my personal use. It is far and away my tool of choice for technical writing. I'm certainly hooked.

Ryan Gale
San Diego, California

PLEASE DELIVER THE GOODS

Recently our support group installed Novell's *NetWare/286* on an AT as a server with a variety of workstations, using Ethernet cards for the workstations and Ethernet Plus for the server. Since then we decided to upgrade the server to the Compaq 386 with a 130-megabyte drive. It took us nearly a week to get everything working, and what disturbs me is that neither you nor your competitors were a lot of help.

In the sidebar "Hurry Up and Wait" ("High-Speed ATs: Life in the Fast Lane," *PC Magazine*, Volume 6 Number 7), Bill O'Brien made brief mention of the dangers of running Ethernet boards at 16 MHz. One of your competitors, in its latest issue, said it had attempted the same configuration as we had without success. In neither case was any mention made of a follow-up with the vendors to see if there was a solution. And in both cases, this information, or lack thereof, appeared months after the introduction of the relevant products. I firmly believe this is an area where the end user shouldn't have to guess. As William Lohse's interrupt of Stewart Alsop's column says, "It's our job to deliver the goods" (Stewart Alsop, *PC Magazine*, Volume 6 Number 7). We're running successfully now, but it was done without assistance from the people we've come to depend on.

John Lamont
New York, New York

S.O.S. FOR DOS

Ethan Winer's two articles on DOS were invaluable (PC Lab Notes, *PC Magazine*, Volume 6 Numbers 4 and 5). Since I just installed a hard disk, they appeared in my mailbox at the perfect time. I especially appreciated the exquisite, exacting detail given to ANSI.SYS, which isn't acknowledged in the IBM DOS manual and is glossed over in other manuals.

However, Mr. Winer failed to address one crucial issue—the 127-byte limit to setting the environment with SET, PROMPT, and PATH commands. The DOS manual says the area will be expanded to accommodate more SET strings if no resident programs have been loaded. I can't even get DOS to accept a long PATH command to search all the subdirectories, let alone to add SET commands (I use DOS 2.1).

Given these restraints, I can't use half of Mr. Winer's suggestions at the same time. Is there a way for me to deal with this problem?

Dale F. Mead
Cupertino, California

Ethan Winer replies:

While DOS has certainly had its share of bugs, I don't think that's your problem. So long as you have not loaded any memory-resident programs, DOS 2.1 will indeed expand its environment to accommodate additional PATH and PROMPT strings. Even with ANSI.SYS resident, I was able to add hundreds of characters. Perhaps you're confusing the 127-environment limit with the 127-character limit of the DOS command line.

A few suggestions come to mind, though. First of all, if you're using the PATH command to search every directory on your hard disk, you might want to consider another approach. On my own sys-

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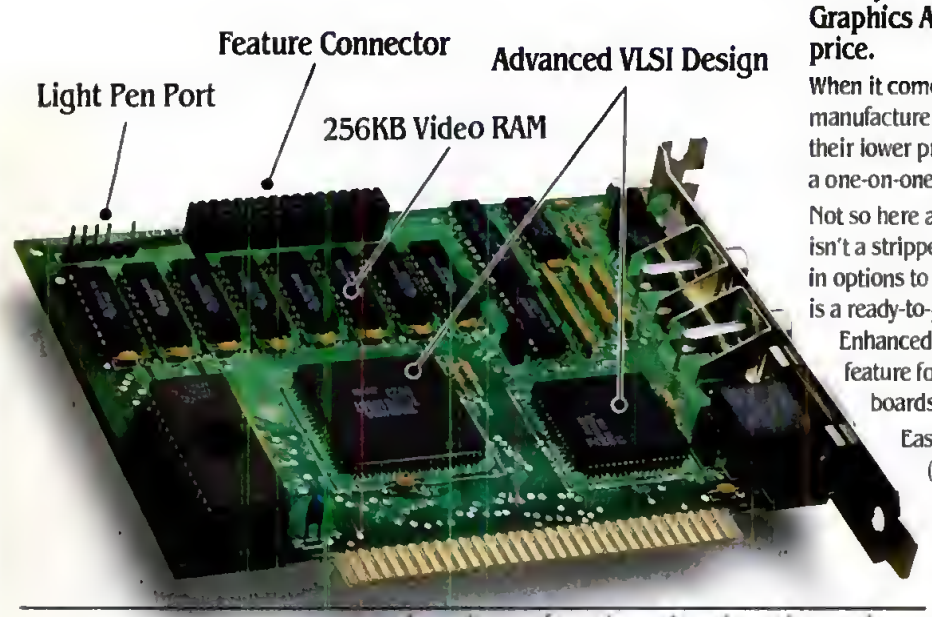

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CIRCLE 470 ON READER SERVICE CARD

■ LETTERS

tem, I have a directory called \BATCH that I use most often. This way, I only need a path for that directory, plus my \DOS and \UTILITY directories. Since each batch file first changes to the appropriate directory, there is never any confusion over where data files will be stored. Furthermore, many programs rely on overlay or configuration files, and this method ensures that they will be found.

You might also consider moving up to DOS 3. Though 3.1 and 3.2 are real memory hogs, they do offer an additional means of creating a large path. By using the SUBST command in conjunction with LASTDRIVE, you can substitute a long pathname with a single drive letter. This way, a PATH command such as SET PATH=D:;E:;F:;G: could actually refer to a series of directories whose names would have exceeded 127 characters if entered the usual way.

The two-part series on DOS (PC Lab Notes) was very informative. Ethan Winer deserves to be congratulated for writing in a way that was not only lucid, but in several places, droll.

Mr. Winer points out that in batch files, DOS 3.*x* does not provide a blank line by the old DOS 2 trick of following ECHO with a blank space. His method of using a null character to achieve this is a new one to me. I usually put two blank spaces after each ECHO to achieve the same result.

Stephen H. Leech, M.D., Ph.D
Norfolk, Virginia

Ethan Winer replies:
I'm sorry, but that's simply not correct. No matter how many spaces you use, DOS 3.x gives the message "ECHO is on" or "ECHO is off" unless you follow the ECHO command with a Chr$(255) or a period.

FONT IMPRESSIONS

After reading Peter Norton's rave on the Microsoft/Hewlett-Packard Z font cartridge (Peter Norton, *PC Magazine*, Volume 6 Number 7), we purchased it. However, one fact missing from his article was that while the cartridge clearly supports the Line Printer 8.5 font in landscape mode, the printer driver that Microsoft supplies with *Microsoft Word* for this cartridge does not support the font. Microsoft personnel confirm that the driver omits this font. They offered no support or promise of a fix for this omission and stated they did not realize there was a problem until we called them.

Patricia S. Olsen
Houston, Texas

CORRECTIONS/AMPLIFICATIONS

The SAM3001 computer reviewed in "The Cheapest ATs Ever" (*PC Magazine*, Volume 5 Number 18) was incorrectly identified as a product composed entirely of Samsung parts. HiTech International, which distributes this computer, provided *PC Magazine* with this information. And, indeed, the review machine that we received performed like a Samsung computer. However, we have subsequently learned that HiTech reserves the option of including non-Samsung components and boards in its computers and that the machine you purchase may not be the exact configuration that *PC Magazine* reviewed, tested, and picked as the Editor's Choice.

Microlytics' *Word Finder* does support looking up synonyms of synonyms and allows backtracking through previously requested synonyms ("Electronic Thesauri: Four Ways to Find the Perfect Word," *PC Magazine*, Volume 6 Number 1).

The correct address for Tech Styles, maker of the C:DOS:RUN T-shirts (First Looks, page 54, *PC Magazine*, Volume 6 Number 7), is P.O. Box 1877, Winter Haven, FL 33882.

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CIRCLE 308 ON READER SERVICE CARD

10 BIG REASONS IT'S TIME YOU CHANGED YOUR EDITOR TO BRIEF

1 FUNDAMENTAL TRUTH. If you are a programmer, you use your editor more than any other tool. If it isn't the best, the fastest, the most versatile, the most productive...well, then neither are you!

2 OUR ENTHUSIASM. While we do not publish BRIEF we wish we did. We sell so many BRIEFs that we've been advertising it non-stop since it was introduced two years ago. We're not alone in our enthusiasm. There is no end of accolades from other admirers:

BRIEF Encounters

"The word is getting around: that BRIEF is simply the best text editor you can buy."
John Dvorak in *Infoworld*

"In the last five years, only a handful of applications have altered the way we use microcomputers. The 'winners' impact is astounding. BRIEF is a 'winner' that will most definitely change the way we develop application software." *Data Based Advisor*

"Overall, BRIEF is an excellent and efficient editor with capabilities that are truly useful. If you're a serious programmer or developer of commercial applications, the BRIEF/dBRIEF package is one of the best investments you can make." *PC Magazine*, 7/86

"Every time I've mentioned text editors I've got a raft of mail urging me to try Brief. Now that I've tried it I see why. It has windows—boy, does it ever have windows! It will do just about anything you want it to; look no further; recommended." Jerry Pournelle, *Byte* 12/86

Best editor of 10 compared.
Dr. Dobb's Software Tools

3 WINDOWS ON THE WORLD. Why the excitement? First, BRIEF's architecture: *Any number of files* of virtually any length can be open. (Start BRIEF with "* *" to prove it.) Open as many tiled windows as fit the screen—over/under and side-by-side—to work on any of your files. Open, close, and resize windows as you go. In each window, full screen or tiny, all editing techniques are at hand—high-speed cursoring, paging up and down, horizontal scrolling, optional word wrap. Load the same file in any number of windows to view different areas simultaneously. A change in one changes all. Cut and paste text blocks between windows and files, or into buffers for later recall. All files stay in memory, so you can always go back to snip some more.

4 WHOLLY MACROS. Much of BRIEF was written in its own macro language. It is that powerful! The language and its compiler come with every copy, as do many standard macros, with source code for learning by example. It is a complete language with conditionals, loops, recursion, global and local variables, even data types. It can control files, windows, and the keyboard. It has structure, 32-character variable names, and—not at all like 1-2-3®'s cuneiform—is entirely readable, like a hybrid of LISP and C. With it you can develop a library of routines to power BRIEF your way.

5 UNDO. NOT UN-DELETE. Don't confuse the two. BRIEF doesn't just keep snapshots of recent deletions should you want to pick them up from the cutting room floor. It can reel the whole film backward undoing any command that affected the cursor or the text. Watch it undo a global replace, for example. Uncanny. It can back up 300 times, all the way to the beginning of a session. "Works like a dream", said *The C Journal*.

6 SHELL GAMES. Leave BRIEF, run your compiler, print out the error messages, load up BRIEF again? No way! Run your compiler from *inside* BRIEF*. It will point to each error line in your source program, still loaded in memory, for immediate editing. You don't have to leave BRIEF to use DOS either. BRIEF disappears from the screen to get out of your way, but say bye to DOS and BRIEF pops back to the screen, as do all the files you were working on.

7 KEY WHIZ. You can reassign BRIEF's command keyhits to whatever keys you're used to, even your old editor's, so you don't have to send your fingers back to school. Macro execution can be assigned to single keys. Or you can tell BRIEF to listen while you tap out a complex routine. It will save and playback faithfully, a shortcut macro without a single line of coding.

8 MULTI-LINGUAL. BRIEF's macro language is perfect for writing formatters for your language which indent, match up parentheses and brackets, and set up statement templates for fill-in. BRIEF comes with C language support already built in. Others have written macros to format Pascal, BASIC, LISP, Prolog, FORTRAN.

9 QUICKER PICKER-UPPER. Looking for something? BRIEF has full UNIX®-like expression search tools to forage and find and fix any file in memory. Literal strings with wildcards and "?" character masking, sure. But also indifference to case or intervening characters, [aeiou] to match all vowels, or [~aeiou] to match anything *but* vowels, [a-f,l-m] to match character ranges, beginning or end of line searches, even multiple choice pattern matching and replacement.

10 REASONS 11 THROUGH 20:
11. BRIEF comes with a color option. You can select your own color scheme anytime. **12.** It supports EGA's 43-line mode and can display up to 128 lines long. **13.** Full 8-bit ASCII display; the whole character set can show on screen. **14.** Full path support. **15.** Command line start-up flags to modify BRIEF's behavior, change a path name, or run a macro: for example "wp" which turns BRIEF into a word processor with wraparound and margin setting. **16.** Automatic file save during idle moments. **17.** Compatibility with most stay-resident programs (like Sidekick™), multi-taskers (like Microsoft Windows™), and networks. **18.** A bulletin board with public domain macros contributed by a mushrooming cult of macromancers. **19.** No copy protection. **20.** Context sensitive help, and phone support from the publisher.

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- Create databases, index files, invoke Ashton-Tate's dFORMAT™ and dCONVERT™, draw lines and boxes

"Simply marvelous programming environment for writing and editing dBASE programs". *PC Magazine*, 7/86. Source code included!

Requires BRIEF 1.32 or later and 384k. 512k to run dBASE within dBRIEF. 640k and harddisk recommended.

* Brief needs 192k normally, 320k for compile feature. •Product must be returned in resalable condition.

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M'soft Windows Compatible

Windows for Data™ adds the pizazz and practicality of window partitioning for entering data in your application Powerful field-level functions let you specify prompt string, field length, data type, screen location, picture, receiving variable, etc Field options can require or prevent entry, cause beeping on invalid entry or overflow, attach field-specific help messages, functions to call for entry validation You control which keys clear a field, jump to next or prior fields, quit, etc

The Windows for C subset has all the windowing functions without data entry Unlimited windows, defined in C structures for reference throughout your program, can be made either to pop up or permanently overwrite the screen Routines scroll and highlight lists with arrow keys, read and scroll ASCII files both ways in windows Logical treatment of video attributes permits unchanged programs to run on color or monochrome Colors of windows are set individually All functions are in separate modules Only those used are linked Only buffers holding on-screen or temporarily obscured windows occupy RAM, others released dynamically Clear documentation

Specify compiler	List	PC Brand
Windows for Data	**$195**	**$149**
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CLIPPER *From Nantucket*

Compile dBASE for Speed, Protection

Clipper™ turns lumbering dBASE® into a speed dMON with benefits bobbing in its wake your source code is submerged from public view, you can distribute your compiled application without royalties, and your customers don't even need copies of dBASE! The Sprng '87 Clipper offers index files compatible with dBase III Plus, and networking capabilities to run compiled programs on major networks supporting DOS 3 1 with no restrictions on number of users Clipper offers arrays, menu-building commands, user-defined functions, context-sensitive help techniques for applications, a debugger, and it supports Expanded Memory It goes well beyond dBASE with 1,024 fields per data base and 2,048 active memory variables

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MICROSOFT C 4.0

A Great C Battle Rages and You're Winning

It bundles a source debugger and a "make", and sports a "huge" memory model permitting single data objects larger than 64k, but what's really impressive about Microsoft C are the benchmarks reported in Dr Dobb's Microsoft runs away from a field of 17 winning 11 of 27 benchmarks

The CodeView™ debugger uses windows to show everything on one screen source alongside disassembled object, variables stack and registers Drop down windows obviate learning of commands "A source-level debugger that puts the rest to shame" said Dobb's

Microsoft C has five memory models for code and data, plus non-library support for another thirteen, and boasts alternate math packages for speed versus accuracy, with or without 8087/80287 chips

Both linker and library manager are part of the package, as is the "make" which knows how to rebuild any size project by compiling only elements which have changed

It is reportedly used by Lotus, Ashton-Tate and, fittingly, Microsoft itself to develop Windows Dobb's calls it "the best MS-DOS C development environment value today [for] virtually any kind of program conceivable" 320k suggested

Ask for	List	PC Brand
G0500	**$450**	**$295**

HALO GRAPHICS SYSTEM *Multi-Board Graphics Library*

The premier graphics library that got the ball rolling for PC-based graphics and has grown so omnipotent that it supports over 25 graphics boards — including IBM's EGA and Nr 9 Revolution's hi-res series — and has a multitude of mouse and printer drivers. All that in each box. Separate C versions for Lattice, M'soft, Aztec, CI86 What does Multi-Halo do? A down to the last pixel graphics library plus functions to reset drivers so distributed program can run on anything Wonderful value for single license Costly royalties though for redistribution Specify S0315 & Language List **$300.** We **$219.** With Dr Halo II a free-standing "paint" List **$440,** Us **$299.**

C-TREE & R-TREE *B-Tree File Manager Now Has Report Generator*

c-tree: Seasoned to perfection, c-tree™ is the only major b-tree file manager with network support in the standard low-cost version It allows multiple users to access an index file simultaneously even during updating Record-locking routines are provided for DOS 3 x, UNIX and XENIX

C-tree even comes in C source code, yet there are no royalties Source sticks to K&R, so C-tree is portable Tests in many environments prove it

C-tree permits any number of keys for a data file—alpha, numeric, even floating point It handles files with varied record lengths and keeps multiple keys in one index file Has both high level ISAM routines to handle details with minimum coding and decomposed step-by-step functions you can access directly In short, you get the works

r-tree: thousands of c-tree users (and you) now have a suddenly expanded ability to produce ad hoc reports from files maintained by c-tree (v 4 1 and up) Just link a file description to the r-tree library, and all you need is an ordinary text editor to write any number of report scripts with no further C coding Reports can access data in several files, select on criteria, join the findings into new logical records, sort them, calculate new fields and columns, tabulate by any number of control breaks The script files show a visual representation of the report image for easy creation and maintenance of even elaborate layouts r-tree™ comes in source, boasts the same portability as c-tree, and fits any compiler

	List	PC Brand
c-tree F0660	**$395**	**$329**
r-tree F0665	**$295**	**$245**
Combined	**$650**	**$541**

dBC *Lattice Library Maintains dBASE Compatible Files With the Power and Speed of C*

dBC™ links C to dBASE It creates and maintains files and their indexes which exactly replicate dBASE file design. So dBASE can read and update them. And the reverse. dBC can use any files created by dBASE Now C and dBASE can operate on the same data bases interchangeably

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dBC's functions parallel all dBASE's file handling commands, many decomposed to give closer control Each backed by demo source files on disk

Use dBC for custom work for clients, or on its own It's a complete ISAM file manager for C whether or not dBASE will be used in tandem, supports all four memory models and can have sixteen index and data files open Big discount to buyers of both dBASE II and III versions. Specify Lattice, Microsoft 3 x, or DeSmet

Versions		List	PC Brand
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Tree Diagrammer prints an organization chart of your program's structure showing the hierarchy of function, procedure, and subroutine calls Shows at a glance what routines call each other for clearer debugging Every shop should have this important documentation tool List **$55**, Ours **$45**

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C source, assembler source, and binary libraries of 225 functions for many compilers Stresses tight functional groupings to minimize loading code your application may never use Manual's 250 pages help select functions, as do demos, bulletin board. Has DOS extensions for file and directory Screen tools for clearing, scrolling, cursor, color, pixel access String operations to add, delete, sort string pointers for top speed Plus graphics primitives, keyboard status, F- key assignment, time/date, read registers, get memory size, peek, poke, plenty more Specify compiler List **$185**, Here **$139**

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A single screen design can have 1000 fields stacked as visual overlays up to 127 levels deep or as pop-ups Each field can be boxed, colored, multi-row word-wrapped, scrolled both ways if larger than its view aperture, assigned a help and error message, accept only certain characters, or match a picture, check data after entry—proper dates, number ranges, etc —or against your own validation routines Customize Panel's test utility with these routines

Panel Plus will operate in graphics mode via interfaces to graphics products it supports Handles EGA's 43 line screen Adapts to various keyboards, screens, operating systems Major tool for the serious developer

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Shopping List for the Power Workbench

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Advanced Trace-86 *Morgan. ASM Interpreter*	175	119
C-Sprite Debugger *by Lattice, source level*	175	139
Microsoft Macro Assembler *with Utilities*	150	109
PASM86 *by Phoenix, Macro Assembler*	195	125
Periscope I Debugger *from The Periscope Co.*	345	299
Periscope II *w/NMI Breakout Switch*	175	139
Periscope II-X *software only*	145	105
Pfix86 Plus *by Phoenix, Symbolic Debugger*	395	235
BASIC LANGUAGE		
Microsoft BASIC Interpreter *for XENIX*	350	295
Microsoft QuickBASIC Compiler *full BASICA*	99	79
BORLAND PRODUCTS		
Reflex & Reflex Workshop	200	129
Reflex *Data Base System*	150	89
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Turbo C Compiler *New*	100	84
Turbo Lightning	100	64
Turbo Pascal & Tutor *New*	125	85
Turbo Pascal with 8087 & BCD	100	64
Turbo Tutor	40	28
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PVCS Network	Call	Call
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PolyXREF *One language only*	129	99
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BRIEF/dBRIEF... *Brief for DBASE III*	275	Call
CLIPPER... *from Nantucket*	895	Call
McMAX... *dBASE for MAC from Nantucket*	295	Call
dBx... *dBASE to C Translator by DESKTOP AI*	350	299
with Library Source Code	550	489
with Full Source Code	1000	855
dBC *from Lattice maintains DBASE files*	250	195
with source	500	390
dBC III Plus *supports multi-user DBASE*	750	595
with source	1500	1185
C COMPILERS		
C86 PLUS *by Computer Innovations. New*	497	397
Lattice C Compiler *from Lattice*	500	299
Let's C Compiler *by Mark Williams*	75	55
with CSD Source Level Debugger	125	90
MWC-86: Mark Williams C Development	495	369
Microsoft C Compiler *4.0*	450	295
C INTERPRETERS		
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Interactive-C *by IMPACC with debugging*	249	219
RUN/C Professional *from Lifeboat*	250	185
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Brief *from Solution Systems*	195	Call
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Epsilon *by Lugaru Software, like EMACS*	195	149
FirsTime *by Spruce Technology, C syntax*	295	229
Kedit *by Mansfield, similar to Xedit*	125	99
LSE, the Lattice Screen Editor *Multi Window*	125	100
Pmate *by Phoenix, with Macros*	195	115
Vedit *by Compuview*	150	99
Vedit Plus *by Compuview*	185	129
FILE MANAGERS		
Btrieve *by Softcraft, no royalties*	250	195
Btrieve Network *by Softcraft*	595	465
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R-Tree *by FairCom-Report Generator*	295	245

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SCREEN DESIGN		
Curses *by Lattice. UNIX screen designer*	125	99
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GSS Kernel System *by Graphic Software*	495	375
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Halo for Microsoft *includes all fonts*	595	434
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Asynch Manager *by Blaise, for C or Pascal*	175	117
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DEVELOPMENT TOOLS		
Code Sifter *by David Smith Software, Profiler*	119	89
Dan Bricklin's Demo Program *Prototyper*	75	69
LMK from Lattice *by Lattice, "make" like UNIX*	195	149
Microsoft Window Development Toolkit	500	365
PC-Lint *by Gimpel Software, after UNIX's "lint"*	139	125
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Pre-C *by Phoenix, UNIX "lint"-alike*	295	174
Pfentesy Pac *six Phoenix products .New Price*	995	Call
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BASTOC *by JMI, convert BASIC to C*	495	399
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Report Option *by Softcraft, Btrieve Report Gen.*	145	128
Xtrieve *by Softcraft, Query Utility for Btrieve*	245	220
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RM/FORTRAN *by Ryan McFarland*	595	Call
FORTRAN Libraries... *by Alpha Computer*	70	45
Microsoft FORTRAN *Links with Microsoft C*	450	281
Microsoft FORTRAN *for XENIX*	695	546
Scientific Subroutine Package *by Alpha*	295	239
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The compiler that put C on the PC. More programmers use Lattice than any other. Its huge libraries (325 functions!) enable the file-sharing and record-locking provisions of DOS 3.1, provide full transcendentals, and utilities to mimic the UNIX™ and XENIX™ environments. Embraces key UNIX enhancements: void functions, enumerated data types, data passing between structures by assignment. Defaults to the ANSI proposed standard, but command line options offer leniency. Also ANSI checking of external data types to swat bugs at link up.

You get small .EXE files, very fast link times and efficient aliasing. New options generate code to use 80186 and 80286 features, 8087 sensed and utilized. *PC Journal* review of 12 compilers called Lattice "a fine product to consider for the production of important applications." Ask for S0100. List **$500**. PC Brand **$299**.

BLAISE *C Tools Plus*

Nothing pays you back quicker than a function library, and Blaise has long been known as a great one. C Tools Plus, the top of the line, now has over 200 functions. Mature, tight, predominantly in C, they isolate hardware dependence, come in source and library, with no royalty. The rundown:

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GSS KernelTM conforms to level 2b of ANSI's Graphical Kernel System (GKS) and contains all its needed drivers and language bindings. Kernel has macro level tools to draw and color an object, store the sequential instructions and re-create the object on its own, as well as segment it, transform it, etc. So powerful, a single command may represent several score lower-level statements.

Kernel has the tools for graph and chart generation, and their captioning: hand it apples and oranges, say "pie," and it bakes the numbers into a digestible display for screen or plotters.

Kernel can convert the images it creates to ANSI Computer Graphics Metafiles (CGMs), a tokenized standard for storing every form of graphic image as data. The Metafile Interpreter reads the contents of a CGM and interprets it with full CGI capability for recreation on various devices.

Quality software? IBM thinks so. They sell the GSS series under their own label.

Unit royalties and annual fees have been instituted for redistribution. Needs 256k.

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Btrieve has mainframe specifications! Its balanced tree indexing scheme finds any key in a million in four or less accesses. Files may have up to 24 indexes, fixed record length to 4090 characters, indexes up to 255 characters, files of 4 billion bytes. Can even extend a file across two drives — even two hard disks!

Version 4.x speeds DOS interaction for large multiply-keyed files, enables variable length records of virtually any length, verifies accuracy (optionally) with read after write, useful in gritty environments, offers password and data encryption.

There's also Xtrieve, for Btrieve file inquiry and data manipulation, and Rtrieve for report writing. All three in versions for any network that supports the MS-DOS 3.1 file sharing function.

Ask for	List	PC Brand
S0650	**$250**	**$195**
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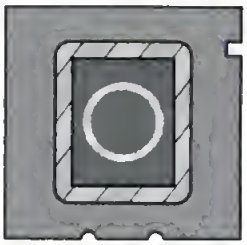

PC ADVISOR

Help in streamlining the hard-disk backup process, in choosing an EGA board for a multiscanning monitor, and in adding flexibility to DOS filenames.

QUAD-DENSITY DRIVE FOR A PC

I am using a Zenith H-148 in my pharmacy. I use floppies to backup my 20-megabyte hard disk nightly, as I can't justify the expenditure for a tape backup. A friend told me I could use quad-density disks instead of the double-density disks I use now, as long as I format the disks on an AT compatible first. Is this true?

Paul Protas
Houston, Texas

Your friend has recommended a surefire way to invoke a disk read error. There is no way you can either read from or write to a quad-density-formatted disk with a double-density drive. You can, however, replace your drive with a quad-density model for a small investment. Weltec Digital (Irvine, Calif.; (714) 250-1959) markets a $149 quad-density drive for PCs, XTs, and compatibles. The drive, Model M16-P12, will run off your existing disk controller.

However, a 720K-byte, 3½-inch disk drive might prove to be a wiser purchase. Though this wouldn't give you quite as much capacity as a 1.2-megabyte quad-density drive, 3½-inch disks are sure to be widely used in the future and are more durable than their 5¼-inch siblings.

IBM retails an external 720K-byte drive at $170. Toshiba America (Tustin, Calif.; (714) 541-1062) markets an internal 720K-byte drive—model ND-354A—for $150. You'll need DOS 3.2 to use either of these drives.

Manzana Microsystems (Goleta, Calif.; (805) 968-1387) offers a 1.44-megabyte, 3½-inch drive that requires only DOS 2.0 or later. The $475 external drive ($325 for the internal model) can also read and write 720K-byte disks.

Finally, it might be wiser to consider loosening the purse strings and buying a tape drive. Mountain Computer (Scotts Valley, Calif.; (800) 458-0300) retails an excellent internal, 40-megabyte tape drive—model TD4440—at $795. For the budget conscious, Micro Design International (Winter Park, Fla.; (800) 328-0891) markets the 40-megabyte, internal MT-408/AT for $595. An external model retails at $695.

CHOOSING AN EGA

I want to buy an EGA board to use with my NEC MultiSync monitor, but I admit I am confused. From what little information I have been able to find, all software must have special drivers in order for an EGA board to produce high-resolution text and graphics, or the adapter must have drivers on-board. What do I need to know to make the right decision?

Glen Whaley
Victorville, California

■ Drivers should be the least of your concerns when choosing an EGA board: your software, not the board, supplies the drivers.

Drivers should be the least of your concerns when choosing an EGA board: your software, not your EGA board, supplies the drivers. If your graphic programs don't have EGA drivers, you're probably using an old version. You should be able to upgrade for a nominal fee.

Since you've wisely invested in a multiscanning monitor, your major concern now should be picking a board that can take advantage of the monitor's flexibility. Since you own a NEC MultiSync, I suggest waiting to read the reviews on IBM's new PS/2 Display Adapter, which will be compatible with PCs and XTs; as of now, the MultiSync is the only non-IBM, multiscanning monitor that we know will work with the PS/2 board, though you will need an inexpensive adapter NEC sells. The PS/2 adapter, which is scheduled for release this month, will give you the PS/2's impressive range of resolutions and colors, as well as EGA and CGA compatibility. It should list for $595.

You've got other attractive options, as well. The latest wave of EGA boards offer features tailored to multiscanning monitors: emulation of all standard graphics modes, automatic switching between modes, and increased resolutions for top programs such as 1-2-3 *and* Microsoft Windows.

With these features kept in mind, any of the following boards would be a smart

■ PC ADVISOR

buy: AutoSwitch EGA 480 Card ($599, Paradise Systems, San Francisco, Calif.; (415) 588-6000); EGA Wonder ($399, ATI Technologies Inc., Markham, Ont., Canada); and SuperEGA ($499, Genoa Systems Corp., San Jose, Calif.; (408) 432-9090).

ALIAS FILENAMES

Our firm has been searching for an MS-DOS facility that will allow us to reference a file by an alias. The software we distribute requires certain input files, but those files change slightly for each client. We need the ability to call different input files without changing the filenames in our source code.

Robert J. Blaney
Hoffman Estates, Illinois

There is no DOS command that directly associates an alias with a filename. However, you can achieve the same effect using simple DOS batch files. For example, say your programs expect to find a file named "input.txt." You can write a batch file that will copy a file to or rename a file as "input.txt" before calling your program. You need only change one line in your batch file to change your input file, and you don't have to recompile your source code.

A host of DOS-productivity packages offer alternatives to DOS batch files in varying degrees of difficulty and usefulness. TopDOS *(FrontRunner Development Corp., Van Nuys, Calif.; (818) 376-1322) offers a command alias function that's easy to use but lacks power. To create a new alias, you type the name of your choice at the DOS prompt and set it equal to any one DOS command.*

PCED *(The Cove Software Group, Columbia, Md.; (301) 992-9371) offers the synonym function, a step above* TopDOS*'s alias function. Like DOS batch files, the synonym function lets you assign multiple commands to one command name.*

Command Plus *(ESP Software Systems, Los Angeles, Calif.; (800) 992-4ESP) boasts the most elaborate DOS command-writing scheme I've seen.* Command Plus *includes a command alias function similar to the one* TopDOS *offers, but its star attraction is its script command file processor. A full array of variable types, operators, input/output routines, and branching and looping statements qualify script as a programming language.*

If you're only looking for a way to give DOS files longer names, PCEasy *(TranSec Systems, Delray Beach, Fla.; (305) 276-1500) has the answer.* PCEasy *allows filenames as long as 32 characters and allows spaces within filenames.*

ASK THE ADVISOR

Send your questions to the PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016.

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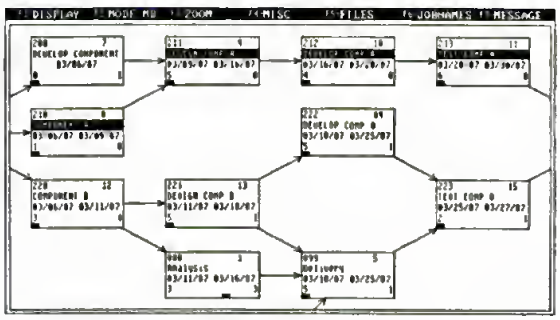

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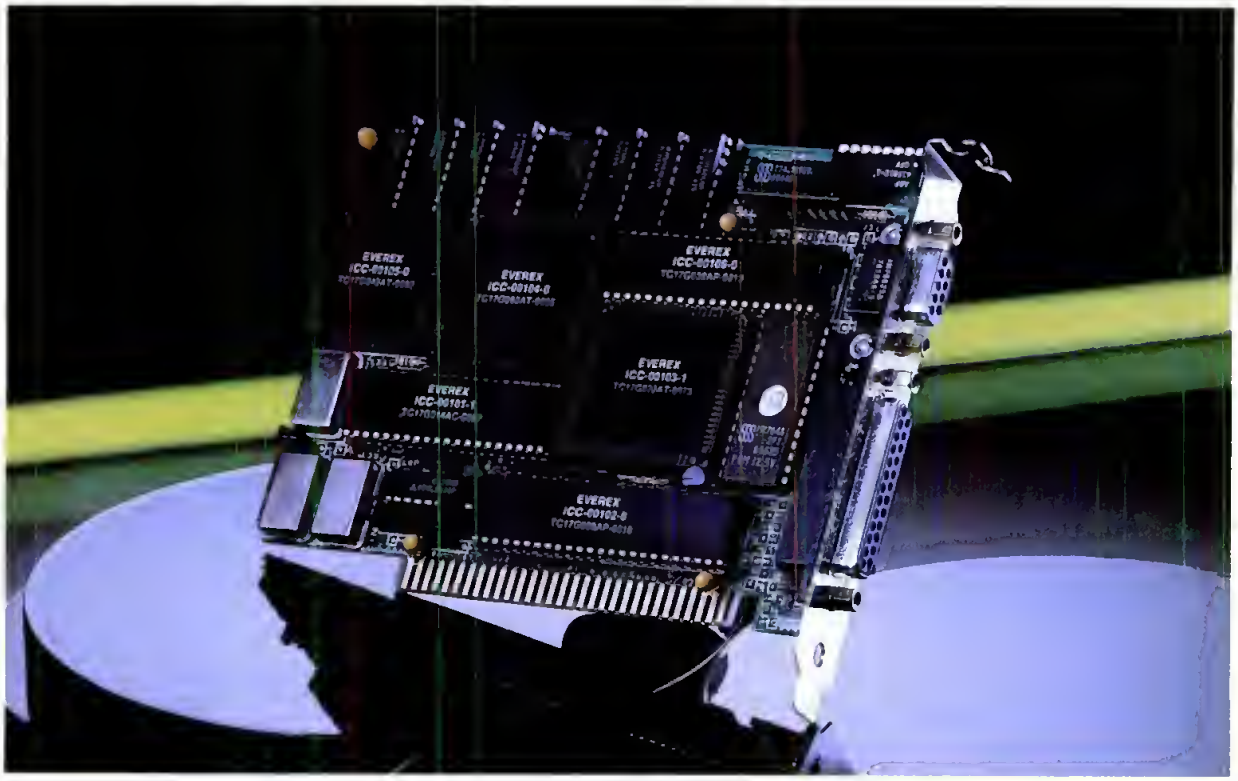

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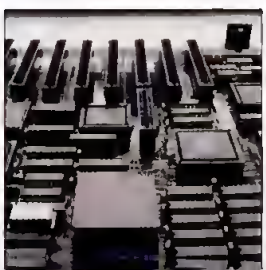

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PC MAGAZINE

FIRST LOOKS

EXCLUSIVE

Kurzweil Desktop Scanner OCR Breaks New Ground

PC HANDS ON

BY TOM STANTON

Few products truly merit the term "revolutionary," but Kurzweil Computer Products' $9,950 Discover System is the first desktop system that delivers what most OCR users have wanted all along: a reliable method of scanning typeset material at a reasonable cost.

To give you an idea of how powerful the Discover system can be, I was able to scan both sides of a page from *PC Magazine*, column by column, in under 5 minutes, then scan graphics in a second pass. In 7 minutes I had an ASCII file from a typeset page converted and ready for use, and a *PC Paintbrush* graphic file. There is no other product on the market today that can do the same thing for less than $30,000.

The Discover uses the popular Ricoh engine, a compact scanner with a very simple paper path, automatic sheet feeding, and an adjustable paper bin that accepts pages from 5½ to 10½ inches wide. You can scan single sheets or a stack of pages up to ¾ inch thick. Graphics-scanning capability spans four resolutions (180, 200, 240, and 300 dots per inch) in your choice of file format (PCX, TIFF, or RES).

The heart of the Discover is a full-length expansion board that has a Motorola 68020 processor running at 16 MHz and 2 megabytes of RAM for storage and recognition, upgradable to 4 megabytes.

Since the Discover board is effectively running as a second computer, you can scan text or graphics in the background and run other applications in the foreground. Performance while running the Discover in the

(continues on page 36)

MultiMate Gets Major Overhaul Yet Retains Logical Structure

PC HANDS ON

BY REBECCA BRIDGES

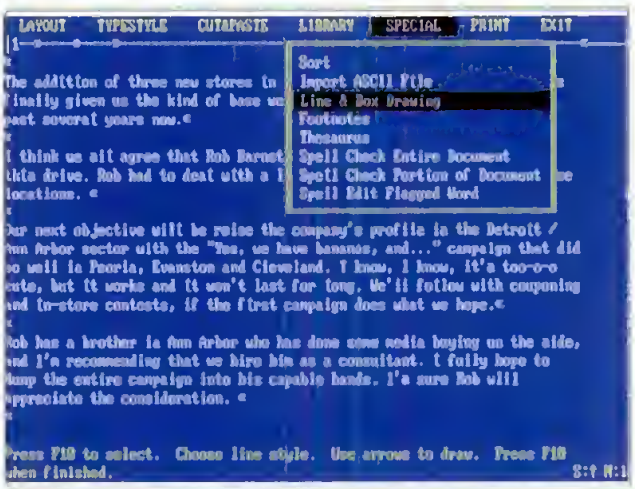
Ironically, as Wang-alike word processors grow up, they are becoming less and less like the parent they were cloned from. *MultiMate* is a perfect example of this irony.

The original version touted all of Wang's features—the good, the bad, and the ugly.

The *MultiMate Advantage II* has eliminated most of the cumbersome, ugly features, leaving us with a few of the bad, all of the good, and many product enhancements that weren't in Wang's wildest dreams.

One of the most disliked features of Wang clones is their page orientation—you can't simultaneously see the end of one page and the beginning of the next. *MultiMate II* corrects this inconvenience by offering document orientation. However, unlike *WordPerfect* or *WordStar*, the pages do not dynamically repaginate after editing changes.

(continues on page 36)



The pull-down menus in MultiMate Advantage II *make it easier to locate commands.*

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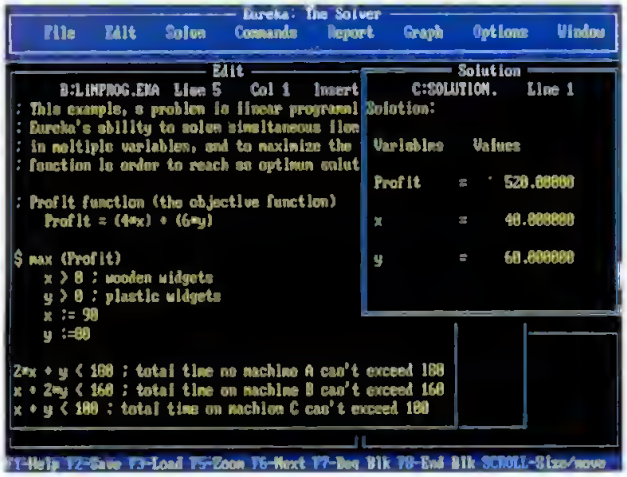
Borland's $99 Eureka—a Fast, Free-form Equation Solver—Finds Optimal Solutions

PC HANDS ON

BY STEPHEN RANDY DAVIS

If you have ever wondered where to turn when spreadsheets start to run out of gas, wonder no more: *Eureka: The Solver* is here. Borland's *Eureka* is, simply put, an equation solver.



Eureka: The Solver *uses linear programming to find solutions to problems with constraints. Here the Solution Window shows the best ratio of two manufacturing lines.*

Eureka's interface is identical to that found in other Borland International products, consisting of pull-down command menus along the top of the screen. Commands may be entered either by pointing at the option and entering Return or by entering the first letter of the command. The user can size and place windows as desired to maximize visible data.

Eureka's built-in *SideKick*-like editor is available from the Edit window. The user enters entire systems of equations using a (more or less) normal algebraic syntax. Rather than using column and row numbers, variables carry descriptive names, such as LoanAmount. *Eureka* even allows comments to be interspersed among equations to heighten readability. Equations can be saved in ASCII format to disk for printing or for later retrieval.

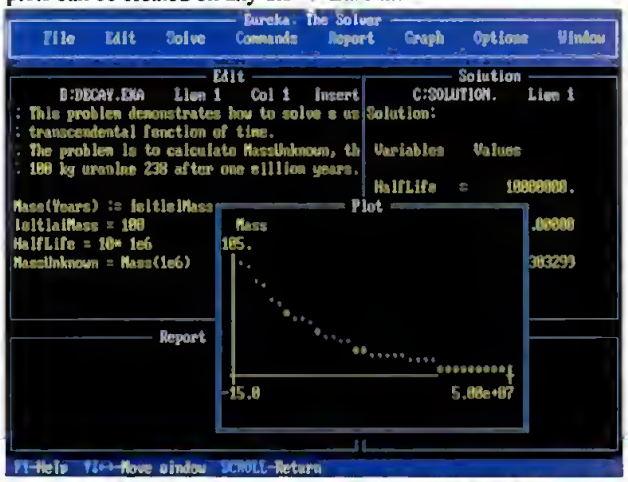
Once finished, the user exits the Equations window and selects Solve from the command menu. If *Eureka* finds a problem in the equation definitions, it returns the user to the Edit window, placing the cursor on the infraction in its best imitation of Turbo Pascal. If no problem is found, *Eureka* enters the Solutions window, in which a list of all of the variables and their calculated values is found.

Once the equation is solved, any user-defined function can be plotted by returning to the command menu and selecting Plot. Crude but serviceable plots can be created on any display—higher-resolution, full-screen plots require a CGA, EGA, VGA, or Hercules display adapter. *Eureka* supports only linear-linear plots—a curious limitation in such a powerful package. You may also direct plots to an Epson-compatible printer.

Finds Best Solution

When creating equations you can define your own functions and units. Built-in functions include trigonometric operations, exponentiation and logarithms, differentiation and integration, polar to rectangular coordinate conversion, present and future values, roots of a polynomial, and the cumulative distribution function. Additionally, the user can place constraints on variables, such as not allowing a particular variable outside of a given range of values. This is particularly useful for minimum/maximum problems, for which *Eureka* attempts to find the "best" solution.

Units may be applied to numbers, allowing *Eureka* to make any necessary unit conversions in arriving at the eventual solution; however, all units must be defined by the user, as none of the standard units of measurement are predefined by *Eureka*.



A plot showing the decay of uranium over time. The formula is in the Edit window. One of Eureka: The Solver*'s weaknesses is an inability to import data.*

PC MAGAZINE FACT FILE

Eureka: The Solver
Borland International Inc.
4585 Scotts Valley Rd.
Scotts Valley, CA 95066
(408) 438-8400
List Price: $99.95
Requires: 384K RAM; CGA, EGA, or Hercules adapter required for graphing functions; DOS 2.0 or later.
In Short: A fast, flexible problem solver that uses the familiar Borland interface of pull-down menus. Not copy protected.

CIRCLE 422 ON READER SERVICE CARD

Ease of use is enhanced by an Include feature that allows one file to include others. In addition, *Eureka* supports a log feature that logs sessions to disk for later, off-line analysis.

Eureka's Report Generator function, while serviceable, is weak; it prints the equations and their solutions with few user options.

No Import Facility

Unfortunately, *Eureka* makes no provision for easily importing user data from other sources.

Eureka is blindingly fast, both in calculating solutions to equations and in its handling of windows and plots. Merely difficult problems *Eureka* solved virtually instantaneously; the almost impossible took a few seconds. PCs not equipped with either an 8087 or 80287 math coprocessor will have significantly slower results.

Eureka is supplied on one non-copy-protected 5¼-inch (or 3½-inch) disk containing *Eureka* itself, an installation program, and 15 example problems. The principles of operation and the example problems are covered in a 250-page, indexed manual. PC

Zenith Debuts Small Desktop PC Geared for Use at Home, School

PC HANDS ON

BY ROBERT HUMMEL

Over the last few years, Zenith Data Systems has earned a reputation for cramming a lot of performance into a small package. The company's laptops boasted state-of-the-art displays, relatively speedy hard disks, high-quality construction, and, lately, faster CPUs. Its new eaZy pc, announced at spring Comdex, takes this miniaturized technology to the 3½-inch desktop world.

The most striking features of the machine are its tiny size; crisp, paper-white monitor; and lack of expansion slots. The computer and monitor are integrated into a single package measuring just 14 by 13 by 13 inches (WDH) and weighing 30 pounds. The large monitor is attached to the system unit with a sturdy tilt/swivel mount. The ease of adjustment and small footprint give it a distinct advantage on crowded desktops.

This is the first of a new generation of machines to follow in the footsteps of the IBM Model 30 and offer 720K-byte, 3½-inch disk drives exclusively. You can buy the eaZy pc in three configurations: the Model 1, with a single floppy disk drive ($999); the Model 2, with twin drives ($1,199); and the Model 20, with one floppy disk drive and a 20-megabyte hard disk ($1,699). The drives are mounted on the right side of the system unit, but the machine sports a disk-in-use light on the front faceplate.

All three versions come standard with an integrated 14-inch monitor, 512K bytes of on-board non-parity-checked RAM (expandable to 640K), a parallel printer port, a 9-pin serial mouse port, a full-size AT-style keyboard, and MS-DOS 3.2. The eaZy pc is also the first system to offer Microsoft's friendly new *MS-DOS Manager* software. You can purchase a slide-in 128K RAM expansion option or a combination add-on containing the same 128K bytes of RAM and a 300/1,200-bit-per-second Hayes-compatible modem that doubles as a serial port. The only other option is a dealer-installed real-time clock ($59) with a 10-year battery that clips below the main CPU.

Zenith's eaZy pc includes Microsoft's MS-DOS Manager.

Zenith has used its laptop technology to produce what is one of the quietest desktop computers ever made. The eaZy pc power supply has no cooling fan and is located inside the monitor, allowing the system unit to be remarkably tiny and quiet. This departure from established PC architecture is made possible by the extensive use of LSI and CMOS components and the elimination of expansion slots on the system board.

The eaZy pc's 14-inch, paper-white monochrome display achieves a dramatic increase in resolution by double-scanning the standard 200-line CGA image. The result is an eminently readable, flicker-free display that uses an 8- by 16-character box (compared with the standard CGA's 8 by 8 box) and eight shades of gray to simulate color while retaining complete CGA compatibility. Even color users will find the sharp white-on-black display very readable and soothing.

Zenith powered its tiny new desktop with a dual-speed 8088-compatible NEC V40 CPU running at 7.16 MHz (downward switchable to 4.77).

Purchasers of the eaZy pc should carefully consider their present and future computing needs. The power supply delivered with Models 1 and 2 is not beefy enough to support a hard disk. Because the power supply is located in the monitor, the floppy-disk-based systems cannot be upgraded to include a hard disk at a later date. The lack of an 8087 numeric coprocessor socket also limits the applicability of the eaZy pc to floating-point intensive tasks.

Bundled with the system is the Microsoft *MS-DOS Manager* program, a character-oriented, windowed user interface designed to insulate the user from the usual command line and prompt. It performs traditional DOS shell functions such as file management and point-and-shoot execution of applications. *MS-DOS Manager* is not an operating environment, like *Microsoft Windows*, but the family resemblance is obvious, so the upgrade to *Windows* or the OS/2 Presentation Manager will be painless.

At $999 for the low-end version and $1,699 for the hard disk model, the machine is overpriced. Cheap clones can run circles around it for far less and offer relatively unlimited expansion potential. In addition, purchasers will have to find a way to port their existing programs and data from 5¼-inch floppy disks to the eaZy pc's 3½-inch floppies.

Zenith sells extensively to schools, where the system will presumably be offered at a steep discount. Purchasers do get an absolutely silent, tiny, capable machine with a good keyboard and monitor, as well as the assurance that they're buying from a well-known manufacturer. But you can't upgrade the motherboard or the monitor, add disk drives, or insert any add-on boards. If you need something small and tiny, and you can buy an eaZy pc for about half the price, it's worth considering. For most users, however, the limits are too many and the price too steep. PC

PC MAGAZINE FACT FILE

Zenith eaZy pc
Zenith Data Systems
1000 Milwaukee Avenue
Glenview, IL 60025
(312) 699-4800
List Price: Model 1 with one 720Kb 3½-inch floppy drive, $999; Model 2 with two 720Kb 3½-inch floppy drives, $1199; Model 20 with one 20-Mbyte hard disk and one 720Kb 3½-inch floppy drive, $1699.
In Short: A small, quiet desktop PC-compatible offering 3½-inch floppy drives, the *MS-DOS Manager* and a great-looking 14-inch paper-white monochrome display, but limited by a high price and lack of expandability.

CIRCLE 445 ON READER SERVICE CARD

Discover

(continued from page 33)

background is affected by your PC's disk I/O and screen refresh. I noticed some sluggishness, but you'll notice the difference only when doing disk reading and writing.

The Discover software requires about 1 megabyte on your hard disk, yet it uses only about 16K bytes of RAM. The installation program makes installation easy, and there's even an option for removing the software automatically. The Discover uses a menu system, but the PC function keys are programmed to automatically run the most common operations. You can define a callable editor or communications program and save these settings, or you can shell to DOS and run other applications.

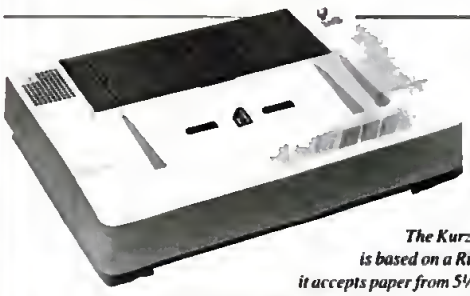
Scanning a full page of text requires almost no preparation, as long as the original is clean. You insert the page in the scanner, select a document name, and start a session. The page moves through the scanner quickly, and a temporary file is created on the disk. This file remains open until you decide to close it, so you can scan a number of pages from different sources into a single document.

The Discover has a scanning window setting that lets you define a single portion of the page for text or graphics scanning. Using *PC Magazine*'s three-column feature format, I defined a window for each column and saved the settings for each column in separate instruction sets. To scan a page I loaded the instruction set for column 1 and scanned the page, then repeated the procedure for subsequent columns.

It gets a little more complicated if there is more than one story on a page, but in those cases I simply loaded the existing instruction sets and modified the windows for a single session. Once I got past the opening page, the scanning was fairly routine. Graphics elements on the page are skipped over during a text scan, so pictures, column rules, lines, or embedded graphics elements can be treated as spaces.

Next I changed the window settings for graphics scanning to isolate a single graphic on the page and scanned the picture into a separate file. The Discover offers a line mode for black-and-white drawings, and two settings for continuous-tone graphics like photographs. The random dither is similar to halftoning in that a given value of gray is approximated by density of dots. Spiral dithering performs the same function, but dot patterns are arranged in spiral patterns. You have to look carefully to notice the difference.

The Discover offers true "omni-font" capability: a single page can have any mix of type sizes (8- to 24-point) and type styles (boldface, italic, and underline), as well as any number of different fonts, and can still achieve recognition. Script fonts or other decorative typefaces are not recognized, and the Discover may not recognize draft-quality dot matrix unless the characters are well formed. Most near-letter-quality dot matrix fonts should be recognized with little trouble.



The Kurzweil Discover System is based on a Ricoh scanning engine; it accepts paper from 5½ to 10½ inches wide. A sheaf of papers up to ¼ inch can be stacked for automatic feeding.

PC MAGAZINE FACT FILE

Kurzweil Discover System
Kurzweil Computer Products
185 Albany St.
Cambridge, MA 02139
(800) 343-0311
(617) 864-4700
List Price: $9,950
Requires: Full-length slot, hard disk (1 Mbyte free), DOS 2.1 or later.
In Short: A desktop OCR that can recognize true typeset characters as well as most other fonts, with separate graphics scanning.

CIRCLE 444 ON READER SERVICE CARD

Once the characters have been scanned and recognized, you close the document and then run a conversion program that creates either an ASCII text file or a DCA (Document Content Architecture) file. The Discover allows extensive programming of ASCII text files with a format program, so it is possible to convert most text-formatting elements into any desired hex character.

If you thought OCR was in its infancy, you were right. But with Discover we've gone from toddler to high-school graduate overnight. Look out, world. PC

MultiMate

(continued from page 33)

I discern two distinct influences on *MultiMate II*: top-selling *WordPerfect* and traditions found in other programs from *MultiMate*'s new owner, Ashton-Tate.

Some of *MultiMate*'s new features (direct import of ASCII files, preview mode to view the printed document on-screen, and nonprinting document comments) are quite similar to those originally found in *WordPerfect*. The Ashton-Tate influence shows itself in the new pull-down menus that look and work like *dBASE III* Assist menus.

The menus offer several advantages over the function keys. First, the menus shorten the learning curve for novices. A new user can locate a command faster on the well-organized menus than on a keyboard template.

In addition, the menu provides a brief explanation of how to use the command; the function key doesn't offer this kind of help. Even experienced *MultiMate* users may find that the menus save them from paralysis if they've misplaced their keyboard template.

Since *MultiMate* is now an Ashton-Tate product, it is not surprising that you can directly merge *dBASE* data into a form letter without conversion. Other product enhancements include undo delete, hot printing (printing the current page without exiting the document), column sort, expanded math capabilities, and automatic or user-selected hyphenation. About the only feature *MultiMate* is missing now is windows. (With Ashton-Tate at the helm, it wouldn't be surprising if the next release has windows called frames, à la *Framework*.)

Despite the trend away from some of the more-cumbersome Wang features, *MultiMate*'s Wang heritage is in no danger of being forgotten. Documents still must be repaginated, headers and footers are awkward, and *MultiMate* still insists that you insert every single code, including tabs and returns.

On the up side, the program has retained its key selling point: a consistent and logical command structure. PC

PC MAGAZINE FACT FILE

MultiMate Advantage II
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(213) 329-8000
List Price: On 5¼-inch disks, $565; premium pack with both 5¼-inch and 3½-inch disks, $595; upgrade, $100.
Requires: DOS 2.0 or later.
In Short: A major upgrade to one of the most popular word processors, adding page preview, pull-down menus, and an undo delete command. Not copy protected.

CIRCLE 443 ON READER SERVICE CARD

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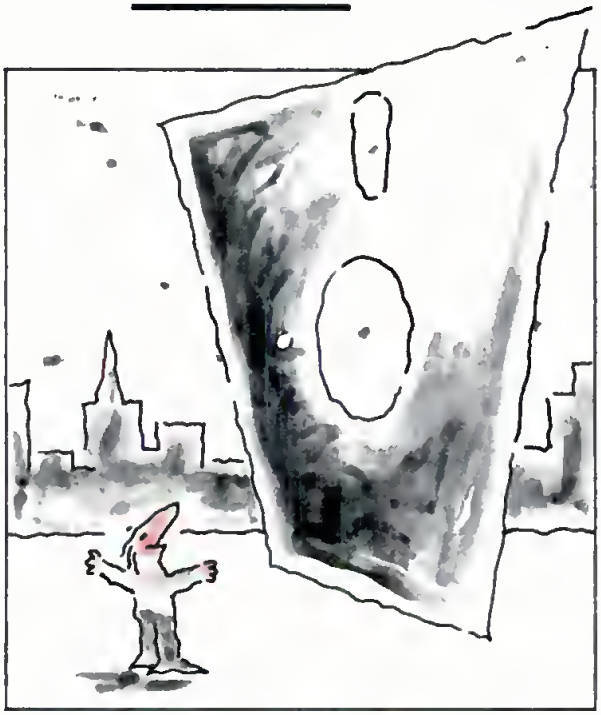

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*Under development, to be released.

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Marion, Ohio 43302
(614) 382-5999

CIRCLE 263 ON READER SERVICE CARD

Plus Doubles the HardCard's Capacity, Betters Performance

HANDS ON

BY WINN L. ROSCH

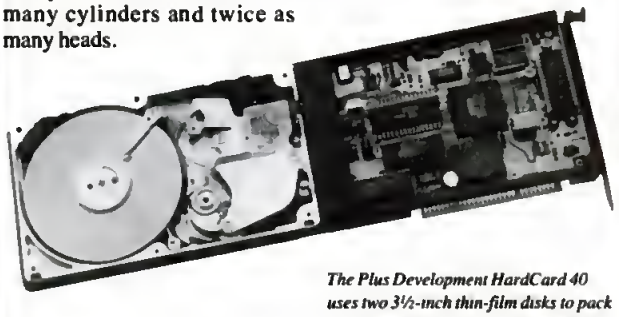
When moving a hard disk from disk drive bay to expansion slot, something's got to give. Usually that something is speed and capacity, but Plus Development Corp. has changed that.

With the new Plus Development HardCard 40, you can put an entire 40 megabytes in a single expansion slot in an IBM PC, XT, AT, many compatibles, or the Personal System/2 Model 30 and still have disk performance that is very close to an AT's stock drive.

Packing Scheme

Although those capabilities are impressive in themselves, the way Plus Development achieves that high capacity in a single slot is more striking still. Because just two tiny platters fit inside the .8-inch-wide package (the same number as used in the earlier HardCard 20), Plus Development has doubled the number of cylinders, to a total of 1,224. And all those tracks must squeeze into a less-than-1½-inch-wide swath across the 3½-inch disk.

The problems inherent in this packing scheme go beyond the space crunch. Current PCs recognize a maximum of only 1,024 cylinders and would ordinarily be unable to handle the number inside the HardCard 40. Plus Development avoids this hurdle by logically dividing the disk so that it looks to its host computer as if it has half as many cylinders and twice as many heads.



The Plus Development HardCard 40 uses two 3½-inch thin-film disks to pack 40 megabytes in a single expansion slot.

In testing, the drive does not quite fulfill its speed promise of a 40-millisecond average access time, delivering true performance of about 50 milliseconds, even though it can do a pure disk seek in about 30 milliseconds.

The track-splitting scheme gives an apparent speed increase on some tests that does not reflect actual DOS performance (such as on the BIOS Disk Seek test). Unlike some manufacturers, however, Plus Development makes no unfounded speed claims for the disk-splitting scheme.

Hardware installation of the HardCard 40 is as simple as it can get for a disk drive—just slide it in. The entire drive draws all 8 watts it normally needs through the 8-bit PC expansion bus. This narrow bus limits performance in full 16-bit systems. In most systems the HardCard 40 will function as the first or second hard disk, and as the former it can boot the host computer.

The HardCard 40 is accompanied by a software disk that includes programs to divide the full 42.26-megabyte capacity of the drive into one to four partitions. A semiautomatic installation program (you press the keys but the software selects the functions) handles all partitioning and formatting.

Although bigger (both physically and in capacity) and faster hard disk cards are currently available—notably the Rodime R-Card 45—the HardCard 40 is fully competitive because of its superior integration, compact size, low power consumption, and, as always, excellent fit and finish. PC

PC MAGAZINE FACT FILE

Plus Development HardCard 40
Plus Development Corp.
1778 McCarthy Blvd.
Milpitas, CA 95035
(408) 946-3700
List Price: $1,195
Requires: DOS 3.0 or later.
In Short: A single-slot, high-performance 40-megabyte hard disk card compatible with all IBM PCs, XTs, ATs, many compatibles, and the Personal System/2 Model 30.

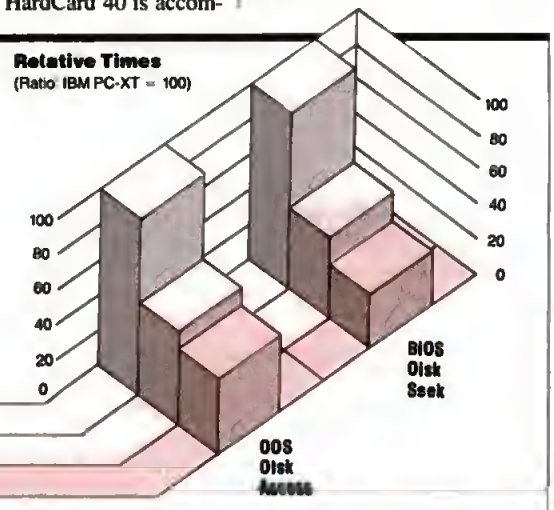
CIRCLE 424 ON READER SERVICE CARD

PC LABS Benchmark Tests: Plus Development HardCard 40 vs. IBM PC-XT and Plus Development HardCard 20

The Plus Development HardCard 40 packs twice as many tracks onto the same number of platters as the HardCard 20. The HardCard 40's performance is faster by nearly 20 percent.

Performance Times
(Times given in milliseconds)

	DOS Disk Access	BIOS Disk Seek
IBM PC-XT	114.00	95.00
Plus Development HardCard 20	60.00	44.00
Plus Development HardCard 40	49.36	29.46



The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the driver's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

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CIRCLE 513 ON READER SERVICE CARD

ANNOUNCING ORACLE's NEW DIS

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WHY WAIT FOR OS/2? RUN LARGE APPLICATI

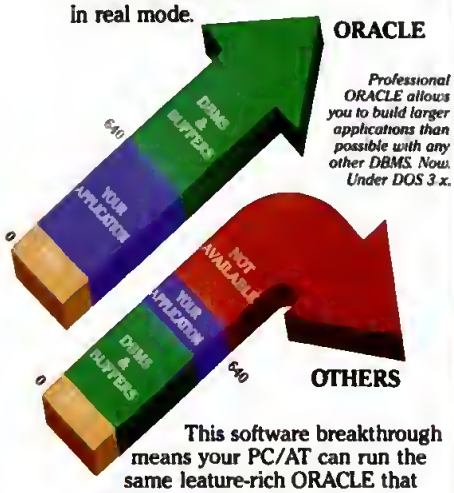
All PC DBMSs have three serious limitations. First, very little room is left for your application after deducting the size of DOS and the DBMS from the available 640K. Second, they don't provide easy, transparent access to minicomputer and mainframe data. Finally, multi-user applications are impractical because of long delays caused by LAN data lock-out. Three serious limitations. Not any more.

In 1979, Oracle Corporation delivered the very first relational DBMS. Oracle also delivered the very first implementation of SQL. And now, we're delivering the first ever distributed DBMS for PCs: *Professional ORACLE,® Networkstation ORACLE® and LANserver ORACLE.®* Three DBMS products that bring mainframe applications, mainframe data, and mainframe power to the desktop. All of which incorporate ORACLE's breakthrough technology. And all deliverable today.

EXPLOITS 286/386 PROTECTED MODE. NOW.

Professional ORACLE is the very first DBMS to exploit the advanced technology ol PCs like the Compaq 386, IBM's PC/AT, and the new Personal System/2.

The ORACLE kernel—the relational DBMS engine—executes in protected mode. Above the 640K line in extended memory. At the same time, your ORACLE applications, tools, and DOS 3.x execute below the 640K line in real mode.



Professional ORACLE allows you to build larger applications than possible with any other DBMS. Now. Under DOS 3.x.

This software breakthrough means your PC/AT can run the same leature-rich ORACLE that mainframes run. Not a down-sized subset. Plus it leaves you plenty of memory to develop and execute major database applications. Without giving up your memory-resident utilities.

SEAMLESS CONNECTIVITY. NOW.

When other PC DBMSes claim "connectivity," they mean terminal emulation or file transfer, downloading and uploading static data snapshots.

With Networkstation ORACLE, an ordinary PC (XT as well as 286 or 386) becomes a true distributed application processor. You can dynamically access and update a remote database—either ORACLE or IBM's DB2†—as il it were stored on your PC.

What's more, ORACLE's SQL*Star distributed database architecture—the first ever on PCs—lets you query or update local PC and remote databases simultaneously. Even join them into a single view. Without knowing where your data is located. So you can distribute your data to where it's used the most. Control, secure, and back it up however you want. And still network it all together whenever you need to.

ORACLE Connectivity—PC to Database Server		
Speed Class	*Media*	*Raw Speed*
Low	Async Lines	<19,200 bps
Medium	3270 Coax	50 Kbps
High	Ethernet	t0 Mbps

Networkstation ORACLE works over Ethernet using DECnet protocols. Over 3270 coax using LU2 data streams. And over RS-232 and dial-up phone lines. With TCP/IP, APPC LU6.2 and other industry-standard protocols to come.

"[Addresses] all obstacles that have prevented full PC participation in a corporation's database-management activities."
PC Week

ORACLE H

- Fully Utilizes 286/386 Technology
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- Database Server For PC LANs
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- Develop Mainframe & Mini Applications On Desktop
- True Multi-User Concurrency
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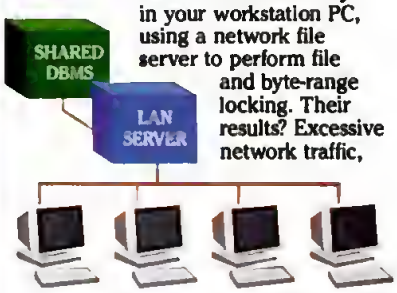
DATABASE SERVERS FOR LANs. NOW.

Using an Ethernet LAN, you can connect Networkstation ORACLE PCs to a variety of powerful ORACLE database servers. Such as the MicroVAX 2000. Soon, you'll be able to connect them to PC ATs, Personal System/2s or the new Compaq 386 running LANserver ORACLE.†

Other PC DBMSes execute entirely in your workstation PC, using a network file server to perform file and byte-range locking. Their results? Excessive network traffic,



frequent waits for busy records, and corrupted databases from aborted transaction streams.

ORACLE's database-server architecture ensures minimum network traffic, maximum concurrency, and data integrity lor the most demanding multi-user applications. Just like a mainframe. And at one-fifth the cost of the least expensive proprietary database machine.

TRIBUTED DBMS FOR 286/386 PCs

THE 640K BARRIER ON THE PC

ONS ON YOUR DESKTOP UNDER DOS 3.x NOW

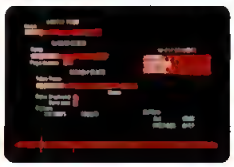
AS IT NOW.

ORACLE	dBASE III PLUS	R:BASE System V
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO
NOW	NO	NO

SQL COMPATIBILITY. NOW.

ORACLE is compatible with both the ANSI-standard and IBM-standard SQL database language.

Which means you can develop applications in ORACLE on your PC and run them on the largest mainframe under ORACLE or IBM's DB2.



You can quickly paint, prototype and enhance sophisticated forms-based applications with minimum effort and maximum flexibility, using such optional facilities as SQL triggers and user exits.

UNRIVALED ORACLE PORTABILITY. NOW.

Moreover, your ORACLE PC applications also become automatically portable to over 30 minicomputer and mainframe families. Under VM, MVS, VAX/VMS, UNIX, and other operating systems.

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Both Professional ORACLE and Networkstation ORACLE come with a comprehensive array of fourth-generation tools for reporting, decision support and application development. Tools that are the envy of our mainframe and PC competition alike.

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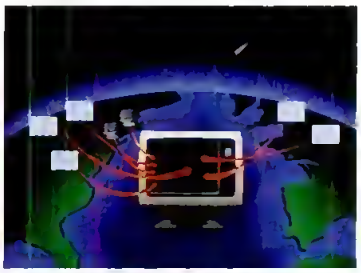

*ORACLE's SQL*Star distributed architecture allows you to manipulate your database—across multiple, dissimilar systems and operating environments—as if all the information were in a single database on your PC*

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☐ Networkstation ORACLE. $695. Requires DOS 2.1+, on an IBM PC/XT, AT, 286, 386 or compatible with at least 512K of RAM (DOS 3.3 on System/2), and LANserver ORACLE on a mainframe, mini or 286/386 PC.

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†DB2 connectivity and LANserver ORACLE for PCs available Q4 1987
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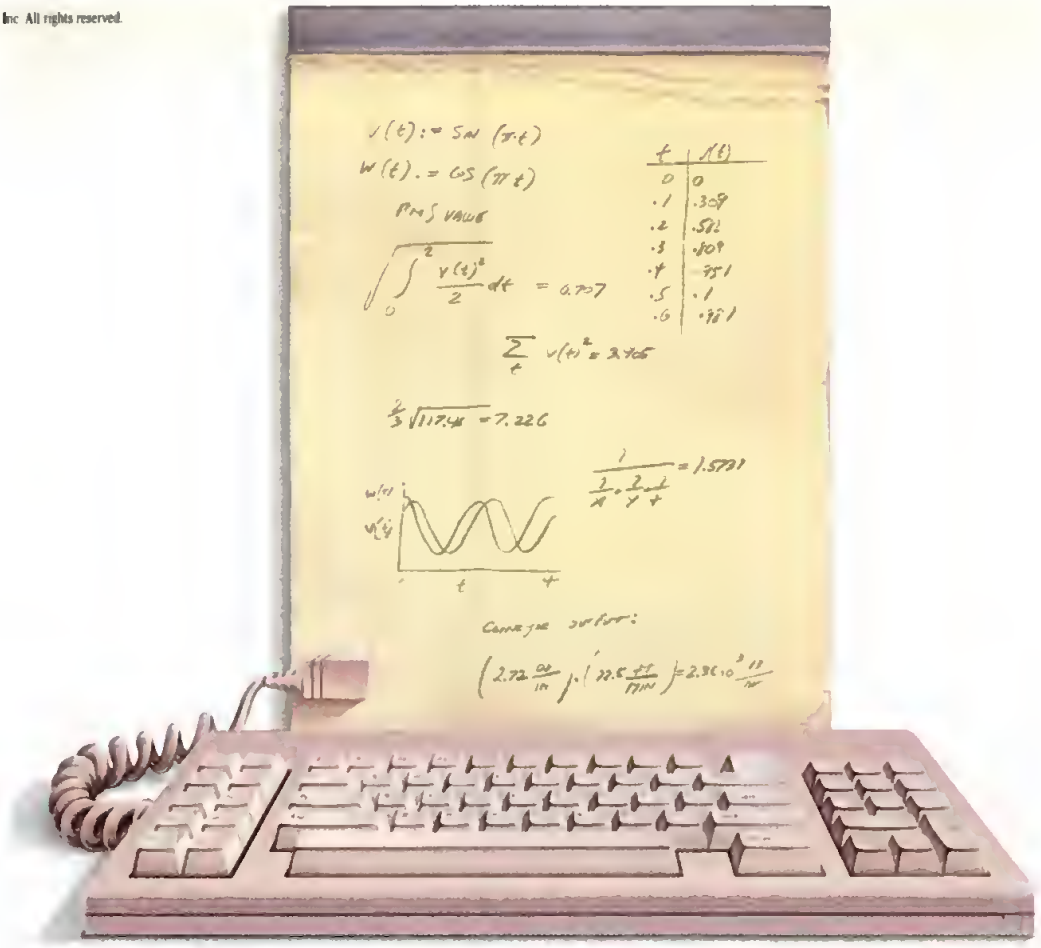
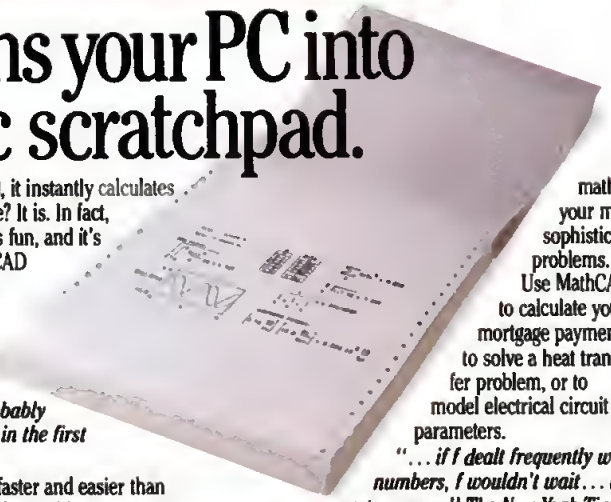


MathCAD™ turns your PC into an electronic scratchpad.



"MathCAD is a real gem of a software package... a program that breaks new ground... the starter of a new software category." The New York Times

It's the first numeric software that works like a word processor. The first software of its kind that's not a programming language. Think of it as the first WYSIWYG calculator. For the first time ever, MathCAD lets you do calculations on your PC in real math notation, as simply as on a scratchpad.

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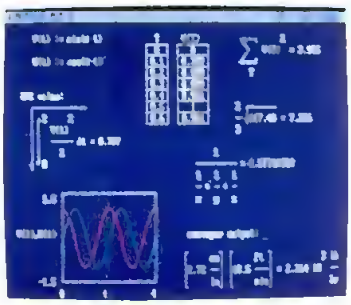
MathCAD lets you combine equations, graphics and text just like you do on paper. You can input formulas directly and edit equations interactively right on the screen. Just place the cursor anywhere and start typing. MathCAD not only formats your equations as they're typed, it instantly calculates the results. Sounds simple? It is. In fact, IEEE Software writes, "It's fun, and it's much easier to use MathCAD than anything you've ever used before."

"It has a free form style that lets you just sit down in front of the PC and do the work you probably bought the computer for in the first place." PC Magazine



MathCAD is much faster and easier than doing calculations by hand or writing programs. And unlike a calculator, MathCAD lets you see and record every step. You can add text anywhere to support your work. And print or save your entire calculation as an integrated document that anyone can understand.

"It's hard to do justice to this software in any review. You feel like you've just discovered the power of a computer for the first time." IEEE Software

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Why spend another minute doing calculations by hand or writing and debugging programs? Put MathCAD to work for you and find out why PC Magazine writes, "Warning: it could prove addictive." Once you've tried MathCAD, it's hard to imagine how you ever got along without it.

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Requires IBM PC® or compatible, 512KB RAM, graphics card.
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CIRCLE 154 ON READER SERVICE CARD

Nota Bene: Grade A Technical, Scholarly Document Processor

HANDS ON

BY EDWARD MENDELSON

Dragonfly Software's *Nota Bene* does almost everything you ever wanted from a word processor, and does it in more ways than you ever imagined.

No other program approaches its fleet efficiency in editing or printing long, complex documents. No word processor gives you such ready access to the full range of technical and foreign language characters. No program with comparable power achieves such ease of use. For handling scholarly work in the humanities and many of the sciences, it has no serious rival. And all its advanced features are available out of the box, without any programming by the user—although you are free to modify and rearrange virtually every detail of its operation.

Nota Bene gets its speed from *XyWrite*, whose engine, in a thoroughly customized version, is at the heart of this new program. *Nota Bene* gets much of its power from its unique integrated "textbase," a database for either free-form or structured text, based on an improved version of the text-indexing program *FYI 3000*. Dragonfly Software has added about 400K bytes of menu and help files (which you can use or ignore) to create a package whose vast capabilities are equally accessible to menu-reading beginners and command-line experts. And the Lotus-style menus are quick and sensible enough to cause invcterate menu-haters to prefer them to the command linc.

Unlike *XyWrite*, a powerful machine housed in a rough-and-ready chassis, *Nota Bene* looks polished, sleek, and eminently logical. It can handle documents big enough to fill multiple hard disks—with automatic cross-referencing to pages and figures and notes from beginning to end—but it's rich in the small details that make editing a breeze. The mnemonics that help you find your way through the densely-packed keyboard are so clear that you'll wonder why no one ever thought of them before.

All operations involving individual words are governed by the Ctrl key, while operations involving sentences are governed by Shift and paragraphs by Alt, so you can perform defines, deletions, transpositions, and athletic cursor-movements with simple key combinations. Other key-combinations let you capitalize or change case, scroll simultaneously in two windows, compare files, edit the next footnote, or change the whole keyboard into one of the standard layouts that are used in Great Britain, France, West Germany, Spain, or Italy. Pop-up keyboard diagrams are never more than just three keystrokes away.

Most programs make you jump through hoops to use foreign or special characters. *Nota Bene* has them mapped to easy-to-remember keys, and knows how to print them. Users of the Hercules Graphics Card Plus get italics and superscripts on screen, and because the program works in character mode rather than graphics, this kind of display doesn't slow you down as it does in *Microsoft Word*. (An option planned for an upgrade will let you work in Greek and Slavic alphabets on the same screen with English—and also let you enter Hebrew text from right to left.) From the menu or command line you can generate three different sets of footnotes and endnotes in the same file, or create sorted bibliographies and multilevel indexes using various sorting routines, or create snaking and parallel columns.

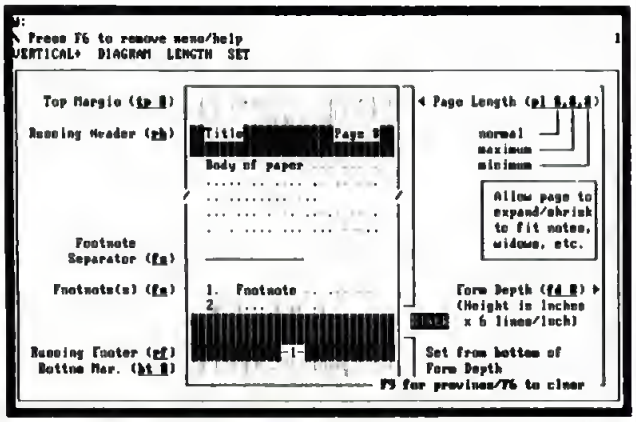
Other features range from optional (and customizable) predefined formats and style sheets, outlining (with hidden levels), macro libraries (35 per file, as opposed to one per file in *WordPerfect* and none at all in *Microsoft Word* and *Manuscript*), nine windows, fully customizable keyboards, fast searches through all disk files, intelligent hyphenation, mail-merge, preprinted forms, and math. Printing options include linked and queued files, typewriter mode, on-screen preview of printed layouts (in ordinary editing, page breaks are indicated only by a page-line counter), and unparalleled control over laser printers. And the features that you do not need never get in the way.

A spiral-bound tutorial provides beginners with an introduction to computers and to the program itself. The full 1,000-page manual looks daunting, but is so well written and organized that it becomes a pleasure to use. Its bulk results from Dragonfly's zeal to anticipate every possible question, whether foolish or sensible, and it assumes that a user is intelligent enough to want to learn the logic of the program rather than simply memorize keys.

The textbase lets you index existing files (without massaging them into special formats unless you want to), and access the index directly from the word processor. Because the textbase can index all significant words, you can use it to guarantee consistency in huge documents, or to generate annotated bibliographies and (for legal documents) tables of authorities.

Nota Bene is compact enough to work with floppy disks (you'll have to switch disks once while the program loads unless you use the 3½-inch model), but it feels cramped without a hard disk. Although you can use it to write simple memos without fuss, it begins to display its ease and power as soon as you start using complex formats that stymie most other programs.

Nota Bene sometimes looks very intimidating, but intelligent beginners will find that it is friendly enough to help them master it.



Nota Bene's excellent control of footnotes includes an easy-to-access page preview.

PC MAGAZINE FACT FILE

***Nota Bene*, Version 2.0**
Dragonfly Software
285 W. Broadway
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List Price: $495; available to graduate students for $275.
Requires: 256K RAM (384K recommended), DOS 2.0 or later.
In Short: A uniquely flexible word processor and textbase program, designed for academic and professional use, but easy enough for intelligent beginners. Exceptional printer control. Not copy protected.

CIRCLE 421 ON READER SERVICE CARD

NEW ON THE MARKET

Maynard Unveils PS/2 Internal Interface for Backup Hardware Line

Maynard Electronics has announced a $295 interface add-in board that allows use of its Maynstream backup units with IBM's Personal System/2 Models 50, 60, and 80. The Maynard microchannel adapter interfaces with the new IBM Micro Channel Architecture bus, so that users can back up from, and restore to, the PS/2 hard disks.

Maynard says the Maynstream units function in the same way with the PS/2 systems as with earlier IBM computers and compatibles. The Maynstream product line includes three portable backup systems that support both ¼-inch cartridge and digital data cassette tape storage technologies.

List Price: Maynard microchannel adapter, $295. **Requires:** IBM PS/2 Model 50, 60, or 80; Maynstream tape backup system. Maynard Electronics, 460 E. Semoran Blvd., Casselberry, FL 32707; (305) 331-6402.

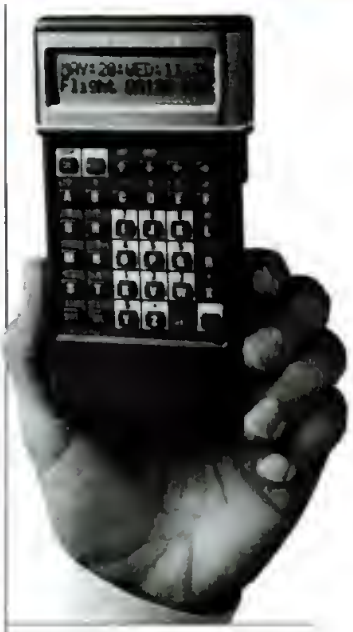
CIRCLE **446** ON READER SERVICE CARD

Calculator-Sized Unit Puts Computer Power In Your Shirt Pocket

DOS in the palm of your hand? Not really, but the tiny **Psion** Organiser II is a true computer nevertheless. About the size of a scientific calculator (5.6 by 3 by 1.1 inches, 9 ounces), the Organiser has a text-only LCD screen and supports up to 320K bytes of on-board memory.

Two receptacles that are located in the back of the battery-operated machine accept solid-state memory units called datapaks, which emulate floppy disk drives and are available in capacities up to 128K bytes. The datapaks retain information at power-down.

Applications that are available in the datapaks include a $79.95 *1-2-3*–compatible spreadsheet with a 26-column by 99-row worksheet. The spreadsheet accepts *1-2-3* worksheets directly from a PC through an RS-232 serial port located at the top of the Organiser.



The Psion Organiser II ($159.95) may be the smallest serious computer ever. It has solid-state "datapaks" that emulate floppy disk drives.

A programming language, OPL, allows user-defined applications, which can be stored in datapaks.

The Organiser II has a built-in clock/calendar and alarm. Calculator functions are performed to 12-digit accuracy. The calculator has full math and scientific functions.

The model CM, with 32K bytes of ROM, 8K bytes of RAM, and up to 64K bytes in datapaks, costs $159.95. The model XP, with 32K bytes of ROM, 16K bytes of RAM, and up to 128K bytes in datapaks, sells for $229.95. The XP supports a bar code reader and magnetic card reader.

List Price: Psion Organiser II, model CM, $159.95; model XP, $229.95. 16K datapak, $29.95; 32K datapak, $49.95; 64K datapak, $64.95; 128K datapak, $179.95. Pocket Spreadsheet software, $79.95. Cable for information exchange with desktop PC, $19.95. Psion Inc., 320 Sylvan Lake Rd., Watertown, CT 06795; (203) 274-7521.

CIRCLE **439** ON READER SERVICE CARD

HOT PROSPECT

Board Makers Ready First XT-, AT-Compatible Boards for VGA Graphics

IBM's VGA graphics standard has already prompted third-party manufacturers to design add-in boards for the PS/2 Model 30 and old bus PCs. **Quadram Corp.** leads the way with its announcement of the ProSync VGA and Ultra EGA/VGA cards.

The $595 ProSync VGA is compatible with the new standard at the BIOS level, Quadram says, and the company will offer a board with register-level compatibility by the third quarter.

The card provides 640- by 480-pixel resolution and displays 16 colors from a palette of 64.

The ProSync VGA does not support graphics Mode 19, which allows display of 256 simultaneous colors from the extended palette; the VGA adapters on the motherboards of the IBM PS/2 series offer up to 256 simultaneous colors from a palette of 262,144.

The Ultra EGA/VGA board (price to be announced) provides 800 by 600 resolution and 640 by 480 VGA resolution capability, both in 16 displayable colors from a palette of 64. The card supports digital output on multiscan monitors. An analog version is expected later this year.

Also on the VGA bandwagon is **STB Systems**, whose $449 Multi Res II supports 640 by 480 resolution in 2- and 16-color graphics (Modes 17 and 18) on multiscan monitors.

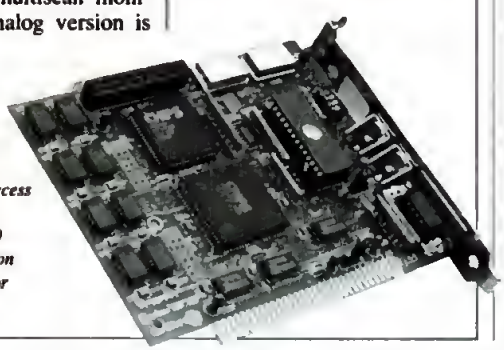
The same VGA modes are supported by the $499 Smart EGA Plus from **NSI Logic.**

List Price: ProSync VGA, $595; Ultra EGA/VGA, price to be announced. **Requires:** ProSync VGA: expansion slot, multiscan monitor; Ultra EGA/VGA: expansion slot, multiscan monitor. Quadram Corp., One Quad Way, Norcross, GA 30093; (404) 923-6666.

CIRCLE **433** ON READER SERVICE CARD

List Price: Multi Res II, $449. **Requires:** Expansion slot, multiscan monitor. STB Systems Inc., 1651 N. Glenville, #210, Richardson, TX 75081; (214) 234-8750. **List Price:** Smart EGA Plus, $499. **Requires:** Expansion slot, multiscan monitor. NSI Logic Inc., Cedar Hill Business Park, 257-B Cedar Hill Rd., Marlboro, MA 01752; (617) 460-0717.

CIRCLE **442** ON READER SERVICE CARD



Quadram's $595 ProSync VGA is among the first add-in cards to give access to IBM's VGA standard at 640 by 480 resolution in 2- or 16-color display modes.

by Jonathan Matzkin

Blue Chip Electronics Expands Low-End PC Line with its $549 XT Compatible

The $549 PC Popular from Blue Chip Electronics may be the wave of the future in home computing. The system comes with software designed for the novice user.

With everyone busily analyzing the new high-end technology from IBM, **Blue Chip Electronics** has introduced a vision of the low-end future.

The Hyundai-made PC Popular is a mass-market entry targeted squarely at the home user. It has an 8088-2 processor running at 4.77 and 8 MHz. The $549 XT compatible comes with 512K bytes of RAM, a 5¼-inch floppy disk drive, a mouse port, and a two-button mouse. A second floppy disk controller is included.

A motherboard-mounted video adapter supports CGA, Hercules, MDA, composite monochrome, and composite color output. The display adapter will drive a conventional black-and-white television set.

The motherboard also has one serial and one parallel port.

The system has two full-size expansion slots and a 65-watt power supply. It comes bundled with MS-DOS 3.2, GW-BASIC, and full documentation.

Monitors are available in green ($99.99) or amber ($129.99) monochrome and in color ($349.99). A second 360K-byte floppy disk drive costs $139.99.

A $49.95 "Ready to Go" software package is designed to get first-time users up and running without referring to a manual. It has a simple word processor, a calculator, an address file, file and DOS management utilities, and games. The kit also has demo versions of software from publishers such as WordPerfect Corp. and MicroPro International Corp.

List Price: PC Popular, $549. Amber monitor, $129.99; green monitor, $99.99; color monitor, $349.99. Second floppy disk drive, $139.99. "Ready to Go" software, $49.95. Blue Chip Electronics Inc., 7305 W. Boston Ave., Chandler, AZ 85226; (602) 961-1485.

CIRCLE **435** ON READER SERVICE CARD

New Graphics Products Allow Color Graphics to Run on Green Screens

Not all the graphics action is in color. Two products allow color graphics to be displayed on monochrome monitors, at significant cost savings.

The $299 ZMM-1470-G from **Zenith Data Systems** is an EGA-compatible monochrome monitor. When used with an EGA, it emulates a color monitor in 16 levels of gray.

The ZMM-1470-G has a green phosphor display and automatically switches between horizontal scan frequencies of 15.75 kHz and 21.8 kHz.

Mode MGA is a $79.95 memory-resident utility from **T.B.S.P.** that allows the display of CGA graphics on a monochrome monitor with a Hercules or compatible monochrome graphics card.

List Price: ZMM-1470-G, $299. **Requires:** EGA card. Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (800) 842-9000.

CIRCLE **436** ON READER SERVICE CARD

List Price: *Mode-MGA*, $79.95. **Requires:** 2K RAM, Hercules or compatible monochrome graphics adapter, monochrome monitor. Not copy protected.
T.B.S.P. Inc., 2265 Westwood Boulevard, #793, Los Angeles, CA 90064; (213) 312-0154.

CIRCLE **437** ON READER SERVICE CARD

Zenith Flat-Screen Technology Monitor Enhances Brightness and Reduces Glare

Increased brightness, greatly reduced glare, and PS/2 compatibility are among the advantages of the 14-inch ZCM-1490 monitor, according to **Zenith Data Systems**. The $999 monitor uses Zenith's flat-tension-mask tube technology along with a nonglare screen coating.

The result, Zenith says, is a 50 percent increase in brightness compared with conventional monitors, as well as 70 percent greater contrast and 95 percent less glare.

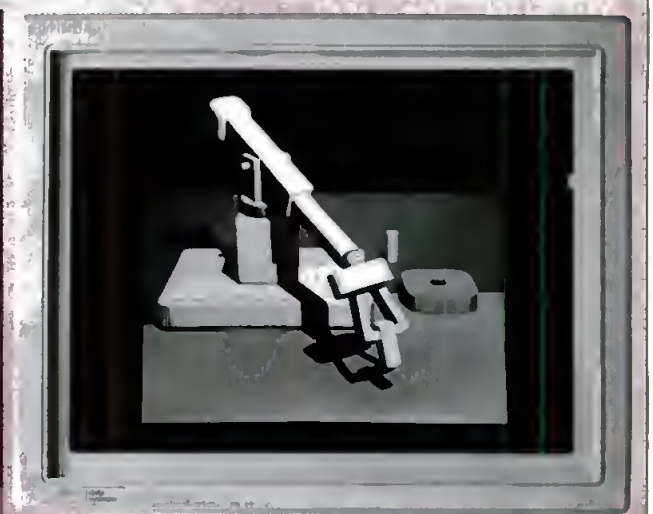
The ZCM-1490 is compatible with the VGA graphics output of the PS/2 series.

The monitor's resolution is 640 by 480 pixels. Horizontal scan frequency is 31.5 kHz, dot pitch is .31mm, and brightness output is 75 footlamberts (fl). Zenith says conventional monitors are rated at 45 to 50 fl.

Zenith is also introducing a VGA-level graphics adapter that is compatible with PCs, XTs, and the Zenith PC-compatible line.

List Price: Zenith ZCM-1490, $999. Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (800) 842-9000, ext. 1.

CIRCLE **434** ON READER SERVICE CARD



Zenith Data Systems' PS/2-compatible $999 ZCM-1490 monitor uses flat-screen technology and a special screen coating to reduce glare and increase brightness.

Glyphix: Low-Cost Satisfaction For Serious Font Fantasies

PC HANDS ON

BY EDWARD MENDELSON

With every laser printer comes a desire for fonts. As an inexpensive substitute for cartridges and soft fonts, you might try *Glyphix*. Somewhat like a page description language, it lets you create an unlimited number of fonts as variants on one typeface. Working from one basic type design, you can specify sloping, boldface, or expanded versions in different widths, slants, and textures.

The program generates fonts by applying your specifications to the letter shapes stored in a supplied "glyph" file. The glyph that comes with the package lets you create fonts in a style resembling Hewlett-Packard's Helvetica.

Glyphix's "Helvette" fonts replace the more-familiar, Helvetica letters.

Glyphix won't let you create anything outrageously original. But if you want to dumbfound your readers with a dozen clashing font designs, it certainly won't stop you.

Unlike a font editor, *Glyphix* can't display characters on-screen and won't let you modify individual letters. It downloads fonts and prints out samples, but you'll need a font-management program and some hard-won expertise before you can use the fonts that *Glyphix* creates.

PC MAGAZINE FACT FILE

Glyphix
SWFTE International Ltd.
P.O. Box 219
Rockland, DE 19732
(800) 237-9383
(302) 658-1123
List Price: $49.95, includes one "glyph" file; additional "glyphs," $24.95 each.
Requires: 64K RAM; Hewlett-Packard Laserjet Plus, HP Laserjet II, or a printer with HP emulation; DOS 2.0 or later.
In Short: Creates different sizes and styles of fonts in a single typeface family. Not the equal of professional fonts, but a lot less expensive. Not copy protected.

CIRCLE 430 ON READER SERVICE CARD

PC-Talk4 Adds Macros, DOS Shell, Abandons Shareware

PC HANDS ON

BY PEGGY GAVAN

PC-Talk III is finally being told to face the competition in the communications software jungle. An enhanced version, *PC-Talk4*, continues the intuitive command structure of earlier versions but balks at tradition with its distribution method. Unlike *PC-Talk III*, *4* will not be distributed as shareware.

In order to successfully compete in the commercial channels, Headlands Communications Corp. has added some practical, long-awaited features to the software and attached an introductory $99 price tag to the package. In addition, a well-made manual is now being shipped with the program.

Perhaps the most significant new feature of *PC-Talk4* is its extensive macro capability, greatly expanding on the simple function key string assignments of earlier releases. Five macro-segment types and 40 macro keys are available for automatic dialing, file transfer, log-on, and log-off procedures. A simple macro editor also makes its debut in the new version.

Another welcome addition is use of the DOS SHELL command, which allows execution of any DOS command or program while communications sessions remain active.

In addition to these features, *PC-Talk4* has an expanded dialing directory for storing up to 990 entries, on-line settings for 300 to 9,600 bits per second, and a redialing routine.

Although Headlands has added Xmodem CRC error-checking to *PC-Talk4*, the program still lags behind many of its competitors. File transfer is limited to Xmodem, ASCII text, and the binary or pacing options. Screen emulation is restricted to TTY and, new to *PC-Talk4*, VT-100 and VT-52.

Extras aside, *PC-Talk4* retains the command structure found in earlier versions. Mnemonic Alt-key sequences call up menus or parameters for communications, and toggle commands invoke such functions as Echo and time display. *PC-Talk III*'s dialing directories and function key files are fully compatible: you just rename the originals.

Headlands took a gamble putting *PC-Talk4* in the commercial market; a bet hedged by the fact that *PC-Talk III* will still be available as shareware. The new release is a must for *PC-Talk III* zealots, but for the unconverted, it is only a moderate maybe.

PC MAGAZINE FACT FILE

PC-Talk4
Headlands Communications Corp.
P.O. Box 8
Tiburon, CA 94920
(415) 435-0770
List Price: $99; update for *PC-Talk III* registered owners, $45.
Requires: 192K RAM, one disk drive, DOS 2.0 or later.
In Short: A commercial version of the popular communications software with several new features, including macros and the Xmodem CRC transfer protocol. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

A New Era for a Software Pioneer

PC-Talk III's transition from a shareware program to a commercial product will disappoint some and stir old memories in others. Andrew Fluegelman was the program's author and one of the original editors of *PC Magazine*. He founded the genre of shareware back in late 1981.

Fluegelman wrote *PC-Talk* after becoming frustrated with IBM's communications program. At first he shared the program only with friends but soon was giving disks to retailers and clubs, asking for a small fee if the program was useful.

The idea worked, and others emulated it. Shareware is now distributed mainly by bulletin boards, at user groups, and by professional services, like PC-SIG. —*Gus Venditta*

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—Robin Raskin, PC Magazine, May 13, 1986

"... excellent desktop publishing program."
—Jerry Pournelle, BYTE, September, 1986.

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Atlas*Graphics: Powerful Map Maker Given Simpler Structure

PC HANDS ON

BY CATHERINE D. MILLER

*Atlas*Graphics* is the second generation of *Atlas AMP*, one of the most powerful map-making programs for the PC. It was an Editor's Choice when compared with its five competitors last year (*PC Magazine*, Volume 5 Number 16) and lost points only for its complicated structure. But this year the program has a new publisher, a new look, and a simpler structure.

*Atlas*Graphics* has six menu-driven modules that allow for detailed data analysis and powerful map-editing capabilities. You get just about every feature that is available in every competing mapping program. And although some of the features are buried in the menus, tutorials and on-line help make it fairly easy to find your way around the program.

Choosing a boundary file to draw your map is the first step in creating a map. You then choose a data file containing demographic or economic data. Sample boundary and data files are included with the program, and hundreds of additional files can be purchased separately.

You can use dot-density or hatching patterns to describe your data. If you use hatching patterns, you can specify up to 20 data ranges and choose from 26 hatch patterns and 16 colors.

Map-editing features let you zoom in on an area an unlimited number of times, create overlay maps, and specify size and placement of maps and legends. You can also create bivariate maps displaying data for two variables instead of one.

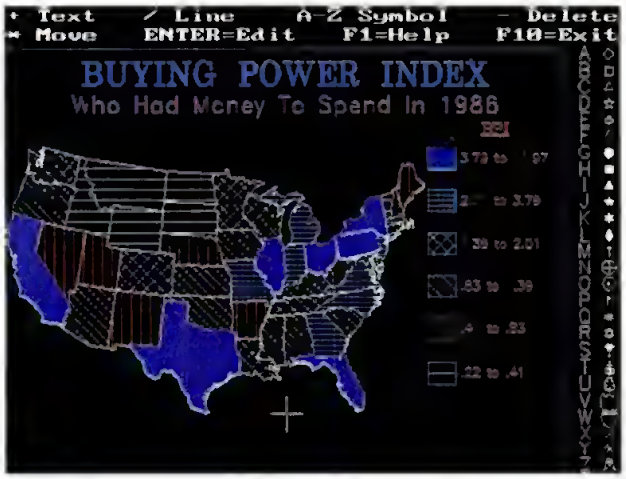
*Atlas*Graphics* lets you place text and symbols anywhere on your map. You can even use all 16 text sizes, 16 text colors, 8 fonts, and 94 symbols on one map.

Use the BoundaryEdit module to change the projection of a boundary file between latitude-longitude, Albers, or Miller projections. ASCII boundary files can be imported and exported, and you can combine boundary files into one file.

Creating a new data file, or editing an existing one, is accomplished by using the Lotus-like spreadsheet in the DataEdit module. Both .DIF and ASCII files can be imported.

*Atlas*Graphics* supports a full range of plotters, the HP Laserjet, and the Polaroid Palette.

No other program can give you this kind of flexibility and power when it comes to customizing a slick-looking map. PC



Atlas*Graphics' *strong suit is tying demographic figures to geographic illustrations. There's an impressive range of customizing features.*

PC MAGAZINE FACT FILE

*Atlas*Graphics*
STSC Inc.
2115 E. Jefferson St.
Rockville, MD 20852
(800) 592-0050
(301) 984-5123 (in Md.)
List Price: $450
Requires: 512K RAM, two disk drives (hard disk recommended), IBM CGA, IBM EGA, or Hercules Graphics Card, DOS 2.1 or later.
In Short: One of the most powerful interpretative mapping programs on the market, *Atlas*Graphics* is especially strong in data analysis. Not copy protected.

CIRCLE 432 ON READER SERVICE CARD

Magna Charter Keeps Graphics Simple

PC HANDS ON

BY BARBARA KRASNOFF

As business graphics software becomes more sophisticated and flexible, it is surprising to find an old-fashioned, one-size-fits-all charting program. *Magna Charter*, from Macomb Computer Systems, converts numbers into clear, well-organized color charts based on preprogrammed formats.

The software operates through a series of point-and-pick menus giving users a choice of eight formats: horizontal pie bar, horizontal stacked bar, vertical bar, vertical multibar, percentage difference, pie chart, area chart, and line chart. Once you have chosen a format, *Magna Charter* carefully moves you through a series of menus that accept your data and label designations (there is also a facility for accepting .DIF files). Each graphic must be saved before viewing; up to 100 charts can be stored in one of up to 100 user-defined files.

Magna Charter is nicely planned in some ways and unnecessarily frustrating in others. For example, once a chart has been saved, it is reasonably easy to go back and change any aspect of the graphic; however, you cannot correct a mistyped number during data entry but must start the whole process over again from scratch. In addition, the program does not have a specific feature for printing out a chart; users are instructed to use the Shift-PrtSc function of their computers. *Magna Charter* is obviously meant for the extremely computer-shy or for users who need to produce a simple on-screen chart on a moment's notice. However, anyone who is accustomed to programs that offer different color schemes, a variety of fonts, and other amenities may find *Magna Charter*'s rigid formats limiting. PC

PC MAGAZINE FACT FILE

Magna Charter, Version 1.60
Macomb Computer Systems Inc.
30612 Jefferson Ave.
St. Clair Shores, MI 48082
(313) 445-6982
List Price: $79
Requires: 128K RAM, one disk drive, color adapter, DOS 2.0 or later.
In Short: A simple but limited business graphics program that may be useful for small businesses that need color charts on very short notice. Not copy protected.

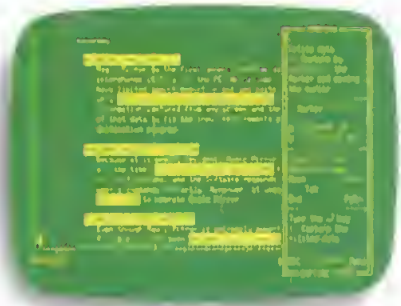
CIRCLE 423 ON READER SERVICE CARD

For high speed, high performance data integration, look into Magic Mirror.™

Now you can move data instantly from one program to another — right from your PC screen.

Now you can transfer parts of a spreadsheet directly into your database — or move sections of a document straight into a spreadsheet — without retyping your data, and without a single mistake.

It's all done with Magic Mirror — the unique memory resident program that lets you quickly select any information directly off your PC screen and instantly feed it into any other program — in exactly the right format, with exactly the results you want.



Highlight only the information you want to feed to another program. Magic Mirror then transfers it instantly, accurately, and effortlessly.

With Magic Mirror, it's easy to do the impossible.

Let's say you're preparing a spreadsheet, and you want to include some budget information from a word processing document.

Simply use Magic Mirror to highlight those sections of the document with the information you want, and save them in memory.

Now call up your spreadsheet, hit a couple of keys, and watch as your budget is automatically entered into the right cells — in the proper format — as though you were typing the information yourself at a blinding speed.

With Magic Mirror it's easy. Without Magic Mirror, it's impossible.

It's the complete do-it-yourself data integration tool.

The secret behind Magic Mirror is its ability to automatically edit and reformat data while it's transferring. That's significant because the way one program displays information is usually not the way another program will accept it. No problem.

Select a few simple options, and Magic Mirror removes dollar signs, inserts carriage returns and other control characters, strips out spaces — whatever it takes to make once incompatible data look and act just like it was entered fot the program you're sending it to.

Plus, it remembers everything it does — from the way it captures data, to the way it edits and reformats, to the way it transfers data. So it's simple to repeat Magic Mirror operations instantly. Or set up routines that others can use with ease.

Get tomorrow's software technology today.

Some day, far in the future, maybe all PC software will share data effortlessly from one application to another. But why wait, when you can do it yourself today at such a very low cost?

Ask for Magic Mirror at computer dealers everywhere. Or order direct from SoftLogic Solutions by calling 800-272-9900 (603-627-9900 in New Hampshire), or send the coupon below. If you find it does not meet our advertised claims within 30 days of purchase, we'll gladly arrange for a prompt refund.

Here's what Magic Mirror can do for you.

- Saves you time and money on communications by capturing and storing just the data you want while running on-line information services. No need to transfer complete files.
- Helps prepare reports quickly using data collected from any number of files and programs, so you get all the advantages of a pre-packaged integrated software system without its limitations.
- Gives you the most powerful integrated software system available when used along with SoftLogic Solutions Software Carousel™. A system that unifies all your favorite software.

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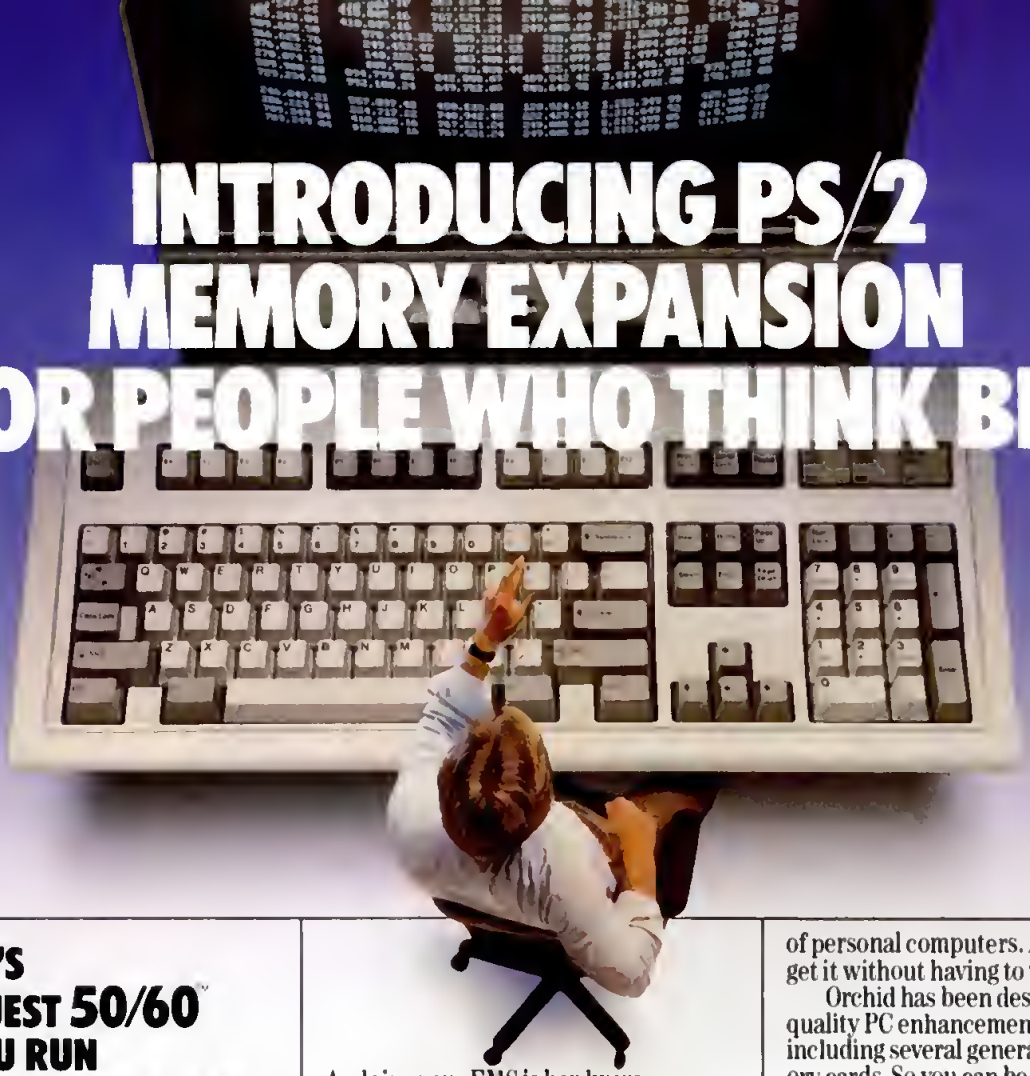
*plus $5.00 shipping and handling

CIRCLE 288 ON READER SERVICE CARD

INTRODUCING PS/2 MEMORY EXPANSION FOR PEOPLE WHO THINK BIG.



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If you try to use an IBM Personal System/2 for serious computing, you'll be disappointed. Because its 1 Megabyte of RAM is only a fraction of what you really need.

But now, Orchid's RamQuest 50/60™ fills that need. It lets you use all the high-performance programs you already know how to run. Without learning new software.

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PLUS FASTER EMS MEMORY.

RamQuest 50/60 conforms to both the extended memory and Lotus®/Intel/Microsoft® Expanded Memory Specifications—letting you access as much memory as your system allows.

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Software Compatibility:	Lotus 1-2-3 V2.0; Symphony V1.1; Microsoft Windows; Framework II

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RamQuest 50/60 features productivity tools that can boost the efficiency of your PS/2 dramatically. These include RAM Disk, Print Spooling and Disk Caching software—utilities that free up your computer. So you can keep on working while they handle slow devices like disks and printers.

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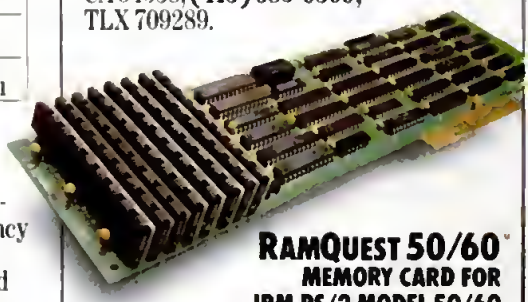

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CIRCLE 492 ON READER SERVICE CARD

QUICK LOOKS

DS Tutor: A Full Course for Novices

HANDS ON

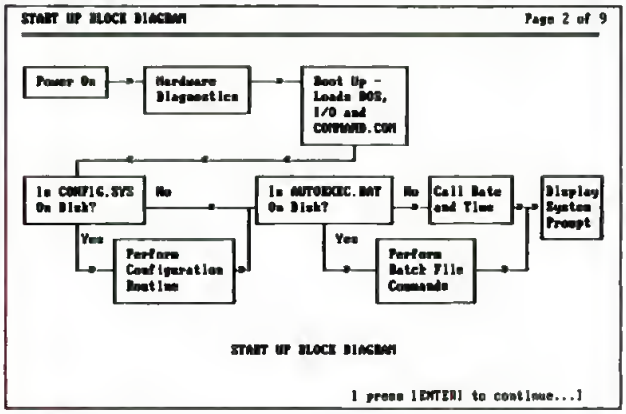
BY GUS VENDITTO

Tired of your role as company wizard for all things relating to a PC? Fed up with three emergency calls a day from each new user who thinks that the red light flashing over the disk drive means to call for service?

Then keep a few spare copies of *DS Tutor*, from Design Software, in your bottom drawer and award them to everybody who gets his own PC. Unlike *Learning DOS* (First Looks, page 48, Volume 6 Number 5) or *DOS Help!* (First Looks, page 51, Volume 6 Number 12), this software guide covers the gamut of PC operations, from a/b switches to video modes.

It's generous enough with instruction that virgin users can open the *DS Tutor* package, read the instructions on a single card, and learn much of what they'll need to know in managing their own systems.

Learning DOS, on the other hand, insists on interactive lessons. Things are not explained, they are demonstrated. That's OK for computer-phobes, who need graphic animation because they are unable to grasp the meaning of copying data from one file to another. But it is extremely tedious to anybody who ever looked forward to graduating from high school.



DS Tutor *starts from square one and explains almost every facet of operating a PC. It can also be used as an on-disk reference.*

DS Tutor gives readers credit for being able to understand English and allows them to move through at their own pace, keeping a glossary available at F1. This program is closer to a reference book on disk than a tutorial.

There are some omissions: a listing for expanded memory doesn't get into DOS's 640K-byte limit and how EMS deals with it; nor does it mention the widely misconstrued concept of extended memory. It explains disk sectors and partitions, but not clusters.

DS Tutor won't turn novices into systems analysts overnight, but it's a good first step.

List Price: *DS Tutor*, $29.95.
Requires: 256K RAM, DOS 2.0 or later. Not copy protected. Design Software, 1275 W. Roosevelt Rd., West Chicago, IL 60185; (800) 231-3088.

CIRCLE **426** ON READER SERVICE CARD

How to Be a Better Writer, Part 2.1

HANDS ON

BY JONATHAN MATZKIN

I am deeply suspicious of editors, and I like the idea of a PC scrutinizing my work even less. But I have to concede that Version 2.1 of *RightWriter*, from RightSoft, is a valuable writer's tool.

The updated style and grammar checker adds 800 new rules to *RightWriter*'s expert system. Along with its other abilities it now can check for missing question marks and unbalanced quotes.

RightWriter analyzes documents created by word processors. It is very good at pointing out annoying mistakes that manual proofreading easily overlooks. The program flags most missed punctuation and is relentless in its identification of passive-voice sentences. It ignores run-on sentences, however, and accepts some obvious subject-verb atrocities.

Not all of *RightWriter*'s suggestions are to be taken seriously. For example, the program flags any sentence of over 22 words as a long sentence. Some situations demand long sentences or even technically incorrect grammatical constructions, and the program can't make that judgment for you.

List Price: *RightWriter*, $95.
Requires: 256K RAM, two disk drives, DOS 2.0 or later. Not copy protected. RightSoft Inc., 2033 Wood St., #218, Sarasota, FL 33577; (800) 992-0244.

CIRCLE **427** ON READER SERVICE CARD

Recovering Damaged dBASE Files

HANDS ON

BY MITT JONES

Salvaging Damaged dBASE Files, by Paul W. Heiser, may not hit the best-seller list, but it's one book serious *dBASE* users shouldn't be without.

Heiser divulges his own secrets for diagnosing and solving the problems that can trouble *dBASE* files. His methods won't bring back overwritten data, but they will salvage a file's remaining data—even when *dBASE* won't recognize the file.

Heiser divides *dBASE* file problems into five classes. To determine which class of problem you have, you consult a two-page diagnostics table. You then turn to the appropriate step-by-step solution.

For files small enough to be loaded into memory, the solution usually involves searching and doctoring the file using DEBUG. Larger files require the use of BASICA programs listed in the appendices. Heiser provides an introduction to DEBUG, and he does an excellent job of writing with clarity.

But don't expect salvaging *dBASE* files to be an easy task. While some remedies require a few keystrokes, others require a great investment of time and patience—especially those involving large files.

In the words of Heiser: "Tedious? Yes. But you want to recover the file, don't you?"

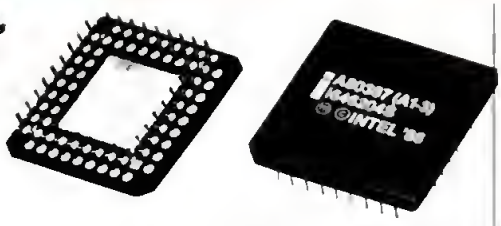
List Price: *Salvaging Damaged dBASE Files*, by Paul Heiser, $19.95. Comtech Publishing Ltd., P.O. Box 456, Pittsford, NY 14534; (716) 586-3365.

CIRCLE **428** ON READER SERVICE CARD

PC UPDATE

edited by Peggy Gavan

Compaq 386, Intel 80387



Intel's 32-bit 80387 coprocessor is now available as an option for the Compaq Deskpro 386.

The **Compaq Deskpro 386** can now be equipped with the **16-MHz Intel 80387** coprocessor. The 80387 option, which provides faster execution of floating-point calculations, is available to current owners for $999; owners must arrange with their dealer for servicing that involves a replacement of the system board. All new Deskpro 386 models will include sockets on the system board for both the 80387 and the 8-MHz 80287 coprocessor. Disk caching, now included on the Supplemental User Programs disk, is available to current users at no charge through Compaq dealers. Compaq Computer Corp., Houston, Tex.; (713) 370-0670.

AT&T 6300, 6300 Plus

AT&T has reduced prices on its **6300** and **6300 Plus** PCs. The AT&T 6300 with one disk drive dropped $295, to $1,485, while the dual-disk-drive version was reduced by $455, to $1,565. The 20-megabyte version also dropped $455, to $2,165. The price of the AT&T 6300 Plus with one disk drive was cut almost $1,000, to $1,590, and the dual-drive version dropped $1,050, to $1,740. The 20-megabyte hard disk model now costs $2,340, a reduction of $975, while the 40-megabyte version costs $3,065, down from $4,340. AT&T, Morristown, N.J.; (201) 898-3278.

Turbo PGA, ProEGA

Orchid Technology's **Turbo PGA** graphics board now comes standard with the **ProEGA** daughtercard, allowing the card to run all software written for the **IBM PGA, EGA, CGA, MDA,** and **Hercules** graphics cards. The enhancement adds support for programs using 256 colors at 640 by 480 resolution. The Turbo PGA, originally priced at $1,495, and the ProEGA, $395, have a new combined price of $1,599, a savings of $291. Orchid Technology Inc., Fremont, Calif.; (415) 683-0300.

Easycolor, CPA Plus, 1-2-3, HAL

FrontRunner Development has acquired *Easycolor* from The Binary Workshop and upgraded it to Version 4.00. In addition, the company has also enhanced *CPA Plus* to take advantage of features in *1-2-3*, Release 2.01, and *HAL*. Upgrades for *Easycolor* and *CPA Plus*, Version 3.0, cost $15 and $95, respectively. FrontRunner Development, Van Nuys, Calif.; (818) 376-1322.

WordStar 2000, Easy Extra

MicroPro International Corp. has reduced the price of *WordStar 2000*, Release 2, and *Easy Extra* by $100 and $50, respectively. The new prices are $495 and $99. The company has also discontinued the original versions of *WordStar 2000* and *Easy*. MicroPro International Corp., San Rafael, Calif.; (415) 499-7676.

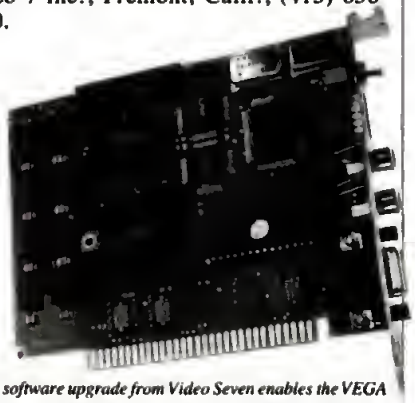
IN BRIEF

CompuAdd Corp. is bundling its ***Fullback*** backup software with all **Miniscribe** and **Seagate** hard disk drives that it sells. CompuAdd Corp., Austin, Tex.; (512) 250-1489 . . . ***OfficeGraphics***, Version 2.0, has several enhanced features, including the ability to edit existing images, and to enlarge, reduce, rotate, circle, and edit images positioned in text. Upgrades are $69. Office Solutions Inc., Madison, Wis.; (608) 274-5047 . . . ***Word Finder***, Version 4.0, is now compatible with *1-2-3*, *Symphony*, *Manuscript*, *WordPerfect*, Version 4.2, and *ThinkTank*. Users should call Microlytics at (716) 248-9140.

PS/2 WATCH

VEGA Deluxe, IBM VGA

Video-7 has announced a free software upgrade that adds several of the new **VGA** modes to its **VEGA Deluxe** video adapter when connected to a multiscan monitor. In text modes (modes 2 and 3), the new driver enables a 9- by 16-character box, instead of EGA's 8- by 14-character box; it also enables VGA graphics modes 16 and 17, which have a resolution of 640 by 480. Video-7 Inc., Fremont, Calif.; (415) 656-7800.



A free software upgrade from Video Seven enables the VEGA Deluxe to support several of the new VGA modes when connected to a multiscanning monitor.

QuadEGA ProSync, IBM VGA

Quadram Corp. has begun shipping a new driver that provides two **VGA** graphics modes (modes 16 and 17) on its **QuadEGA ProSync** graphics board when driving a multiscan monitor. Current owners can purchase the software driver for $10. Quadram Corp., Norcross, Ga.; (404) 923-6666.

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—Glenn Hart, PC Magazine, December 9, 1986.

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—George Goley, Data Based Advisor, November 1986.

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—Pat Adams, NYPC User's Group Publication
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CIRCLE 114 ON READER SERVICE CARD

COMMUNIQUÉS

by Bill Howard

Amazing Facts I

"Laser printers . . . create type by exposing paper to a laser beam."

—Computer Genealogy, *by Paul A. Andereck and Richard A. Penve, Ancestry Inc.*

Amazing Facts II

"AST's SixPakPremium [lets] you . . . run up to nine DOS applications concurrently."

—Erzel Corp., San Francisco, catalog

Is Lotus Laughing?

"Lotus 1-2-3, the mathematician, has an easy-to-sue formula: @ std(list)."

—Lotus 1-2-3 Simplified, *by David Bolocan, Tab Books*

Is it co-written by Charles Atlas and Bobby Fischer? (Micro Center, Columbus, Ohio, flier)

Isn't the Box Worth Something?

An ad for Access Microcenters in *InfoWorld* (April 20, 1987) offers Access brand DSDD floppy disks at "48 cents each . . . box of 10, $8.75."

How Much Do You Charge for Disks?

A Byte Center ad assures prospective customers, "In accessories try these prices without competence."

Computers That Love Too Much

"If the computer accesses the hard disk and TCS-100 at the same time, your system might ruin your date's integrity."

—Tandy TCS-100 Interface Board manual

I Said We Sell Spelling Checkers—Who Said Anything About Using Them?

"Whoops! [spelling checker and thesaurus utility] or Lescript deno disk free."

—Software Sales, Walnut Creek, Calif., ad

"Words are checked against the 88,000 word Proximity/Merriam-Webster Concise Electronic Lexicon—which includes proper names and appreviations."

—Ad for $79.95 Franklin Spelling Ace

"In addition to a Thesarus, automatic outlining, sorting, avanced Speller, WordPerfect has added . . . a winning combination of features!"

—Egghead Discount Software flier

"D&A [database]. Used with English-like commands, has a word processor and a spelling checker."

—Crain's Cleveland Business, *March 30, 1987*

This issue kicks off a new feature in Communiqués: cartoons. You'll be seeing the best work of some of America's brightest (and most demented) young illustrators. Intelligent submissions are welcome —B.H.

Mea Culpa

As long as *PC Magazine* makes fun of everyone else's bloopers and how's-that-again? headlines, we are fair game, too. To wit:

OfficeWriter's Enhancements Put Polish on the Printed Page

—*Headline*, PC Magazine, First Looks section, *Volume 6 Number 4, page 54*

". . . you'll probably never see 8087 support built into QuickBASIC."

—PC Magazine, *Volume 6 Number 9, page 332*

"Most notable [additions to QuickBASIC 3.0] are support for a numeric coprocessor."

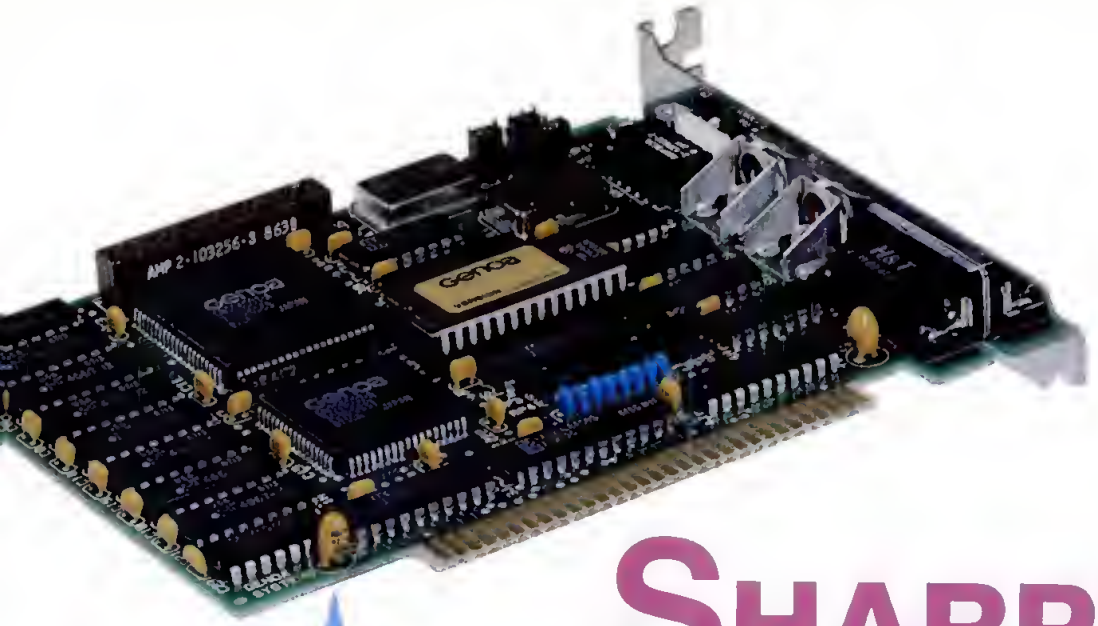
—PC Magazine, *Volume 6 Number 9, page 33*

Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to Communiqués, PC Magazine, One Park Avenue, New York, NY 10016 or MCI Mail 157-9301. Contributors receive $50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails.

As always, please remember: not every typo or newspaper gurble is funny. Which is why the editors have large wastebaskets.

Winners for this issue: Edward Hinz (Whoops!), Sandra J. Davis (Spelling Ace), Paul A. Steckler (D&A), Richard Ash (Chestmaster), Jon Rudel (loser beam), Kevin Hindley (AST), Bob Shirley (Access Microcenters), Les Lynn (Byte Center), Carol Bernstein (Isaac's daughter).

Illustration: Joseph Farris



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CIRCLE 208 ON READER SERVICE CARD

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DEC Emulation Inquiry #365/DG Emulation Inquiry #366/HP Emulation Inquiry #368

■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

FINISH THE JOB, IBM

The Personal System/2s are among us. The line has some remarkable features and some remarkable holes. If IBM won't fill them, the aftermarket will.

Quick. Which is the biggest winner in the PS/2 lineup? The Model 50, of course. Its small size, relative to its power, makes it extremely desirable. What's the biggest flaw in the Model 50? The number of slots? The clock speed? The amount of RAM? No, no, and no.

It's that blasted hard disk. Oh, it's cute enough, the way it snaps in and out. But what a pig. Eighty-millisecond access time and a stinking 20 megabytes? Give me a break.

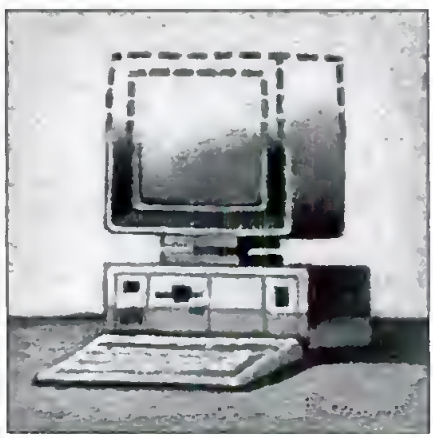
IBM kisses off the problem with a disk-caching program. It's fast and it's sophisticated, but it's no substitute for a faster disk. I'm glad IBM has blessed the concept of disk caching on PCs, but I'll take lower access times any day. Then I can use the cache program and get some *real* performance.

What this machine needs is a bigger, faster disk. But the marvelous snap-together design of the Model 50 is your worst enemy. It precludes anything but a 3½-inch half-height disk drive. Fortunately, several drive manufacturers, most notably Rodime, stand poised to fill the gap. Expect to see 30- and 40-megabyte half-height drives with 30-millisecond access times sometime soon. The street prices are likely to be under $1,000. Once 70-megabyte drives become widely available with the Models 60 and 80, expect 30- and 40-megabyte half-heights from IBM.

DISPOSABLE DRIVES Three years ago, people shelved their full-height floppy disk drives in favor of a pair of half-height floppies and a hard disk. Trouble is, what do you do with the 20-megabyte drive that came with your Model 50? Throw it in the trash can? No way. I predict a boom market in little rubber feet that you attach to the bottom of the old drive. That way you can replace the 20-megabyte 5¼-inch CMI drive on your desk with a state-of-the-art paperweight or conversation piece. What do you do with the CMI, that bane of the PC AT? Get even: open it up and put a big, greasy thumbprint on the top platter.

Seriously, IBM's bundling the 20-megabyte drive into the Model 50 is a disincentive to the drive aftermarket, but not a fatal one. The full-height floppy conversion cost a lot more then than the one we're talking about now.

MONITOR MANIA The view of the future is clear—and in 16 colors with 640- by 480-pixel resolution. But as John Donne reminded us, "We see now as through a glasse darkly." The dark glass in this case is the new lineup of color monitors. Contributing editor Charles Petzold refers to them as the "too" series: too fuzzy, too small, and too expensive.



The bottom-of-the-line monitor is a generous 14-incher, but it suffers from too-large pixels with its .43mm dot pitch. The result is fuzzy text and ill-defined 640 by 480 graphics. This monitor is best suited to looking at the pretty pictures in 320 by 200 mode. Also, it's a stripeline tube, like many television CRTs. That's great for TV, but I prefer round pixel clusters for characters and computer images.

Next in line is the 12-inch model, with .28mm dot pitch. Before that bowls you over, remember that you need .28mm dot pitch to resolve 80 characters' worth of dots on a 12-inch screen. With a 13-inch screen you can get by with .31mm pitch.

At the top of the heap is the magnificent 16-inch 8514 monitor, a $1,500 beauty with (check this) .31mm dot pitch and 1,024 by 762 resolution. Do you really want to spend $1,500 for a monitor? How about for a whole department full of them? Me neither.

Before you get the idea that I hate the new monitors, let me remind you that no one has ever before produced an analog monitor at these prices. Even the 16-incher is a bargain compared with what you'd have spent for an equivalent monitor a few months ago.

The multiscanning monitors are sitting pretty, with their 13-inch screens, analog mode, and high resolution. Those of us who bought them are congratulating our-

Illustration: Darryl Lagasan

■ FROM THE EDITOR'S SCREEN

selves. Of course, we'll need special adapter cables. Not only is the new IBM pinout different, but new signal pins tell the computer whether the monitor is color or monochrome and what its resolution is.

For you product planners, I see some opportunities in the lineup. The first is a 14-inch high-resolution color monitor. A .31mm dot pitch should do the trick. The second one I would add is a 17-inch monochrome monitor for desktop publishing page composition and CAD. On a 17-incher you can lay out two pages side by side, and it avoids the incredible bulk of the 19-inch screens. IBM is on the right track with 64 shades of gray on its existing monochrome monitor, but 13 inches isn't big enough for page composition.

Thanks for the megabyte, IBM, but it just isn't enough. The Model 80 will ship with 2 megabytes on the motherboard. It should have 4. And Models 50 and 60 should have 2 megabytes. There're too many hungry mouths to feed: The disk cache program wants the 384K above DOS. *Windows* wants a RAM-based swapdisk. *1-2-3* wants expanded memory. And you want a RAMdisk for your batch files and often-used programs.

■ The marvelous snap-together design of the Model 50 is your worst enemy.

I know you can add memory on the Micro Channel bus, but IBM's big tout for these machines was throughput, remember? Actually, IBM has half of the solution in the form of the single-inline memory modules (SIMM). The Model 50 has two sockets and the SIMMs are a half-megabyte apiece. The Model 60 has four sockets and the SIMMs are 256K bytes apiece. So you'd think you could put the modules from the 50 into the 60 and you'd have 2 megabytes. Unfortunately, it doesn't work that way. The BIOS doesn't recognize the extra RAM.

The 50 should have four sockets, too. Third-party manufacturers may be able to solve the problem with megabit surface-mount chips, but it will probably be cheaper to combine memory with I/O ports on expansion cards, the same as memory boards for the existing PCs. There's no performance penalty, but it does use a slot.

The Model 50 is a good computer. And it'll be a great computer when it's finished. PC

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At this point, it's tempting to compare ourselves to the competition, but we'd rather quote Datapro, who describe our Express System as "a quantum leap ahead of the development tools included with dBASE III Plus." Which makes it little wonder that InfoWorld considers System V "a superset of dBASE III Plus more likely than ever to turn dBASE loyalists into expatriates."

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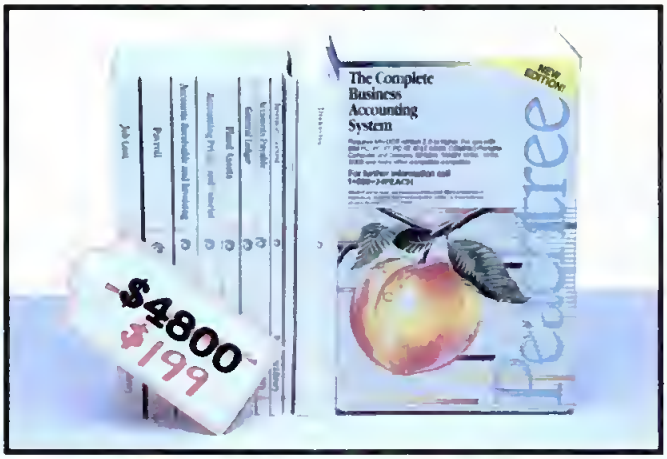

Q. What does Peachtree Complete include?

A. 1. Eight Integrated Software Modules:

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2. An Installation Guide to lead you step by step through our simple installation procedure.
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4. Tutorials on each module with sample data to make learning easier.
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Q. Is Peachtree Complete really the same product that used to sell for $600 per module?

A. Peachtree Complete is basically the same accounting system that both Peachtree and IBM sold for about $5,000 but with substantial improvements in function and presentation.

With more than 150,000 users to its credit, Peachtree Complete has been the PC World Class Winner in its category for two of the last three years.

Q. What's the difference between Peachtree Complete and the $69.95 systems?

A. Peachtree's system is called Complete because it contains the eight most needed accounting packages (including payroll) and all reference materials for one price. Remember, it was designed as a $4,800 accounting software system.

The $69.95 systems, on the other hand, are incomplete. They were designed to sell for $69.95 and require the purchase of additional modules to be comparable—payroll, $49.95 more; tutorials, $19.95 each; etc. Everything is a la carte.

Q. How soon will I outgrow the system?

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CIRCLE 152 ON READER SERVICE CARD

■ JOHN C. DVORAK

THE REAL COST OF THE PERSONAL SYSTEM/2

The rumor mill has been whispering that IBM has enough leeway to reduce PS/2 prices enough to undercut the clones. This time the rumors are wrong.

By now we should be sick and tired of the fuss over the PS/2. The announcement and its aftermath resulted in more misinformation and dubious observations than any announcement since the rollout of the original TI personal computer (the one that was going to dominate the market). The most dubious of the information concerns the money IBM has to spend to make one of the beasts.

The story begins with the pre-rollout gossip. The first solid rumors about the machine began to surface about 3 weeks before the announcement. A Texas PR man, Marty Winston, of Winston & Winston in Fort Worth, sent an MCI message to all his friends outlining about 80 percent the details of the machines, including the name. This memo got around so much that a friend of mine at Unisys later called me and read me the memo, saying it was sent to Unisys from a source in Japan at Mitsubishi!

PARTS AND LABOR FOR $150? Winston said in the memo that the machines cost IBM $150 to build. Somehow that got interpreted by more than a few people as total cost. Soon a few columnists were talking about how cheap the machine really is, as if the total price were $150, parts and all. Since the memory chips in the Model 50 cost more than $150, we can assume that these writers were dazed. This was all used as a rationale to say that IBM had tons of price leeway it could toy with if it wanted to kill the clones. Some people still think IBM has this leeway.

The fact is that the machine (let's talk about the Model 50) probably costs more than $150 to build, anyway. Overhead, interest, and labor at IBM aren't cheap no matter how many robots it put in. Then there's the cost of parts. The entire machine is composed of expensive surface-mount chips. These aren't cheap, by any means. Add to this the custom VLSI at a conservative 40 bucks or more a pop, a 3½-inch drive, a new power supply, a ton of expensive connectors, and a hard disk, and you spend $600 or more for the bag of parts.

THE MANUFACTURING COST Now I'd figure at least $200 to piece it together, test it, and pack it. It's a known fact that IBM's robotic factory isn't reducing costs as much as was hoped for. Total cost, so far: $800. With a monitor at, say, $250 and a keyboard at $50, we've reached a total expense of $1,100.

The typical manufacturing cost to retail

is 3 to 1 or 4 to 1. This depends on how many middlemen and salesmen need to line their pockets. It also depends on the marketing and advertising expenses. Whatever is left shows up as a profit. I figure the profit to be in the neighborhood of $600 per machine. This means the Model 50 has to sell for between $3,300 and $4,400 with monitor. In fact, a Model 50 with the 8513 monitor lists for $4,280. Close enough for rock and roll.

This indicates some leeway, but not enough to undercut the cheapest clones. And let's not forget the upgrade possibilities. I've seen three 80386 motherboards that sell for $1,495 and fit neatly into your old XT.

I hear that IBM has a lowball price sheet it shows around when trying to land big accounts. I assume that the numbers approach the $3,300 mark for special customers. This is still not cheap when cloners can sell a faster machine for around $2,500.

So I think it can be safely said that: (a) the PS/2 will not come down in price soon; (b) IBM doesn't have the great leeway some would like to believe; (c) better deals are to be had.

As is the nature of this business, though, things get cheaper. The cost of VLSI, hard disks, and support chips is forever falling. Someday, surface-mount chips may be cheaper than the pin-mount variety. So surely the price will come down one day a few years from now. For the moment, what you see is what you get. There is no hidden agenda. That is, unless you think IBM gets parts for free!

Illustration: Daryl Lgasan

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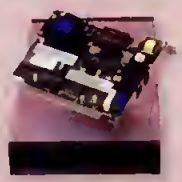

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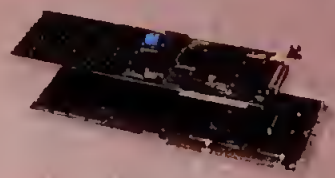

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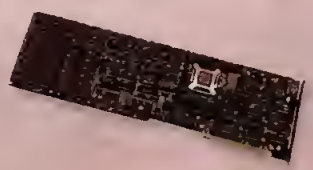

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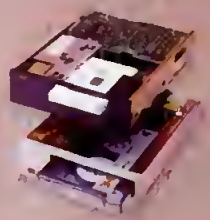

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CIRCLE 122 ON READER SERVICE CARD

■ JOHN C. DVORAK

INSIDE TRACK

The last musings about the PS/2, perhaps . . .

A good story comes from an insider at Microsoft. Now we know how IBM kept quiet the details surrounding the Micro Channel bus.

IBM did give out a number of machines to OEMs, all right. But it encased all of the new machines in lead! Inside the box, the machine was wrapped in a lead foil that couldn't be removed without alerting IBM to a breach of security. It also couldn't be X-rayed. Curiously, the company felt no initial need to lead-foil the Model 30. That is, I'm told, until the boys at Microsoft started to fool around inside the machine to test some Microsoft hardware. "We showed the IBM rep some things we did, and the next thing you know, he left and returned with the lead foil."

The big controversy within IBM, though, wasn't security. It was the color of the logo. The design itself of the new logo isn't new—the logo for the new Personal System/2 is taken right off the wall of the retail product centers. Yup. That sideways angle is right from the now defunct Retail Products Centers. Notice the various colors, too. Some logos are black on silver, silver on gray, black on whatever. These different combinations represent different divisions and teams within IBM. Apparently, there were angry arguments over what colors to use. Each group battled for its color combo. Apparently this issue became more important than anything else to many employees. What a life—arguing about logos.

Genuinely Interesting Software Dept. or Benchmark-Testing the Model 50 at the Office Dept.: I like to play with benchmark programs. I discovered a couple of unusual ones that I ran on the new machines.

The first is the **Landmark CPU Speed Test** ($29.95 from Landmark, 1142 Pomegranate Ct., Sunnyvale, CA 94087; (408) 733-4035; included is a great setup utility for real-time clock setting, add-in memory changes, and so on). It tells you, in real time, the effective clock speed of your computer as compared with a PC-XT and a 6-MHz one-wait-state PC AT. The Model 50 clocked the effective CPU speed as 9.8 MHz, indicating a sluggish 10-MHz system with one-wait-state memory. My old 8-MHz no-wait-state custom AT runs at an effective 10.3 MHz on this test. So the IBM is no screamer. Get a copy of this nifty benchmark and try it on your equipment. It's worth having for the setup utility alone.

I also like to look at the data transfer rate of the hard disk along with the track-to-track speed. The fastest disk in the world with superfast track-to-track doesn't do much good if the controller won't let anything past it faster than 500,000 bps. *That's* the most data that can be transferred from disk to memory on a PS/2. Ask the technology writers what they're talking about when they say the disks are running data out at 10 megabits—something I've read three times in different publications.

A good test for data transfer rates is the Coretest from Core. Core is the premier disk drive upgrade company. If you can't get a copy from a BBS or user group, the company will send it for $20 handling (Core International, 7171 N. Federal Hwy., Boca Raton, FL 33431; (305) 997-6055). Coretest tells me that the effective data transfer rate of the Model 50 hard disk is about 450,000 bps. Not bad. The average PC-XT and AT transfer data at about 150,000 bps. The speed increase on the Model 50 is mostly due to the 1:1 interleave and addition of a memory cache, the best-known ways to increase performance on a disk system. But even 450 isn't great. On my AT at home I have the Super PC-Kwik cache (from Multisoft, Beaverton, Ore.) installed as a 256K-byte cache residing in the expanded memory, and I get an effective data transfer rate that averages 750,000 bps using the Coretest—faster than the controller could ever handle. If the cache has just been loaded or flushed, the number flies off the scale.

Doomsayer Dept.: While talking to the boys at Core, I found out something interesting. They trashed their Model 50 hard disk each time the machine was jiggled or moved. "We formatted it eight times!" I was told. "If this turns out to be a general problem," says Core honcho John Simonds, "then it will be a bonanza for us."

The Fly in the Ointment: Some feel that Intel's recent attempt to can its relationship with AMD as a second source for the 386 is a move influenced by IBM to keep any cheap 24-MHz parts a few years away. The reasons are obvious when you look at the IBM minicomputers.

In a desperate attempt to keep the 286 the chip of choice, IBM even forced Microsoft to make OS/2 usable on the 286. The software boys all know that the 80386 is a chance to start from scratch and build a new operating system. But IBM said the new system has to be usable on AT-class machines, thus creating an operating system that won't cut the mustard. To make matters worse, Microsoft will want $795 for a full-blown version. *And* developers have to shell out $3,000 for a developer's kit for OS/2. From the looks of it, OS/2 might easily become the Lisa of software. It remains to be seen whether or not Microsoft has a Macintosh of software waiting in the wings. PC

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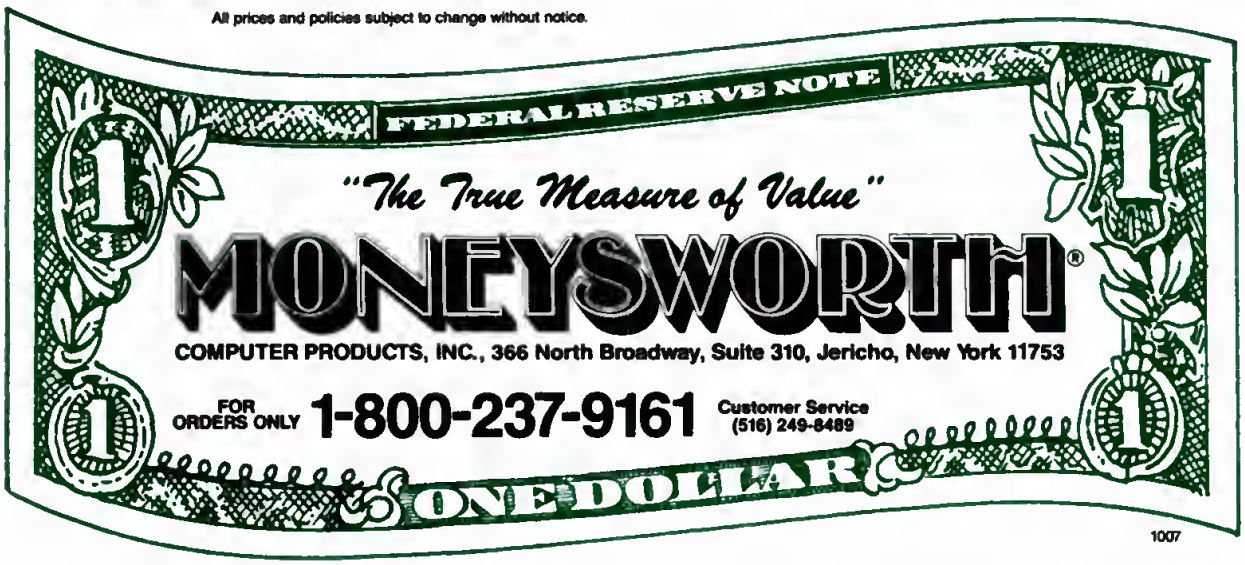

1007

Why Your Hard Disk May Be Only Seconds Away From Total Failure!

WELCOME TO THE INNER WORLD OF HARD DISKS: WHERE MICROSCOPIC PROBLEMS CAUSE MAJOR CATASTROPHIES.

A typical 20-megabyte hard disk contains over *200,000,000 bits*. If only *one bit* changes or fails, you can lose *all* your data. Hard disks are subject to so many inherent, uncontrollable conditions that random failures occur with alarming frequency. You may already have been "treated" to one of these when you saw an unfriendly message like **GENERAL FAILURE, ERROR READING, WRITE FAULT, BAD SECTOR, SECTOR NOT FOUND, FILE ALLOCATION TABLE BAD, DISK ERROR READING FAT, DISK NOT READY, INVALID DRIVE SPECIFICATION, NON-SYSTEM DISK OR DISK ERROR, READ FAULT, BAD DATA** or **NON-DOS DISK**. Here is why:

PROBLEM ONE: OUT OF ALIGNMENT. There are hundreds of circular tracks packed into every inch of your hard disk's magnetic recording media. They are *extremely* thin, about as thick as a single hair. Perfectly aligned tracks on a new, out-of-the-carton herd disk look like those in **figure 1**. Your programs read, but *never* write, to any of the special Track and Sector ID areas shown.

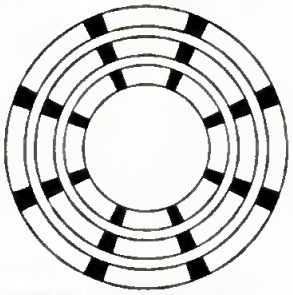

Figure 1* PERFECTLY ALIGNED TRACKS. The black areas store Track and Sector ID information. These are "read only" and *never* written to. The white areas store your programs and data.

When your system has been off and is cold — in the morning, for instance — head positioning mechanics shrink, causing heads to read and write towards the inside. As the unit warms they expand and tend to read and write towards the outside. Add friction, wear-and-tear, play, torquing, repeatability, vibration, irregular platter and surface expansion, etc. — and within a very short time your tracks can go out of alignment like those shown in **figure 2**. This is a continual, serious problem: valuable data may be written so far-off current head tracking that it is no longer readable, resulting in devastating errors and lost data.

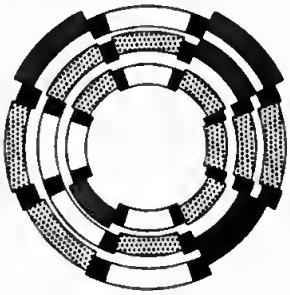

Figure 2* TRACKS OUT OF ALIGNMENT. The most frequent cause of lost or unreadable data. Read "Problem One."

Disk Technician™ Automated AI Software System's early warning detection *must be used daily* to keep tracks in perfect alignment. When even the slightest change is detected, Disk Technician safely removes any data and stores it in your computer's RAM, then restores perfect alignment by rewriting the *entire* track, *including* Track and Sector ID areas, using Disk Technician's own *factory low-level, Real format*. This new track is then thoroughly retested, *and only if has been perfectly repaired*, will Disk Technician allow your valuable programs and data to use it again. If retesting reveals that any spot is not perfect, data is relocated to a good area and the bad area is safely blocked from future DOS use. *This is a totally automatic, unattended process.*

PROBLEM TWO: MEDIA AND DISTANCE. The typical distance between the head and the media is about 25 millionths of an inch. By comparison, a smoke particle is about 10 times greater and a human hair is over 100 times greater! Expansion and contraction caused by normal heating and cooling, wear-and-tear, media degradation, vibration, humidity, platter wobble and aging all cause this distance to vary (see **figure 3**). *Read and write quality varies directly with these distance changes.*

No matter how carefully the hard disk media was manufactured, there still will be variations in coating thickness, smoothness and magnetic density (see **figure 3**). Add aging and magnetic retentivity changes, and some spots may change from "good" to "unreliable" *overnight*. Magnetic herd disks act just like old photos: they fade away — along with *your* data! *Disk Technician is the only total solution to all of these problems.*

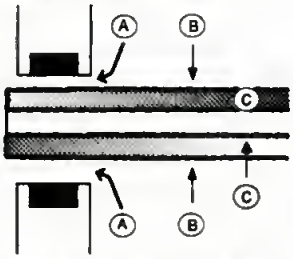

Figure 3* HEADS, MEDIA and THE PLATTER. Read "Problem Two." A: The distance from the heads to the media continually changes. B: The magnetic coating varies in thickness and smoothness. C: Magnetic retentivity both varies and decays.

***Magnified and simplified for clarity.**

Disk Technician *reads, writes* and *tests every single bit on the herd disk, occupied or not*, using special proprietary testing and repair algorithms to check for soft error rate, magnetic retentivity, and the ability to read and write *perfectly*. If even the smallest imperfection is found, Disk Technician will automatically proceed with its complete repair and restoration process. DOS and other programs can only tell you after 10 to 30 errors have been made. Our testing reveals that once a spot makes more than 3 to 5 soft errors, total failure is imminent. *Disk Technician's daily preventive testing, repair and recovery is the only real cure.*

PROBLEM THREE: POWER. Turning power on and off, brownouts, surges, spikes and static electricity all can cause the heads to write meaningless "garbage" into whatever track they happen to be located over. Although hard disks and computers are designed to minimize accidental head writes, they *still* occur and cause devastating damage — often wiping out an entire disk. *Disk Technician takes a new approach to cure these problems.*

The first time Disk Technician is run, it automatically installs SafePark™ and creates a "safe zone" on your hard disk's innermost tracks, safely relocating any data in this area. Then, whenever you boot from your hard disk, SafePark becomes memory resident and operates with all of your programs all of the time. When there is no disk activity for 7 seconds (user adjustable), SafePark automatically moves the heads to the safe zone. Once the heads have been moved — which will usually be the case — damages will be confined to the safe zone, thus protecting your valuable data and programs.

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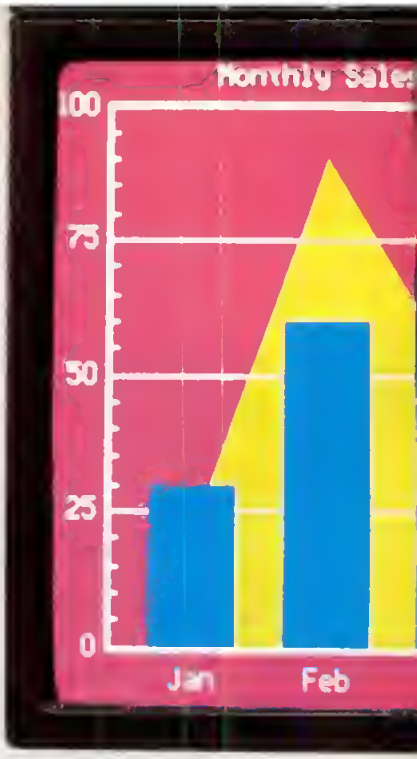
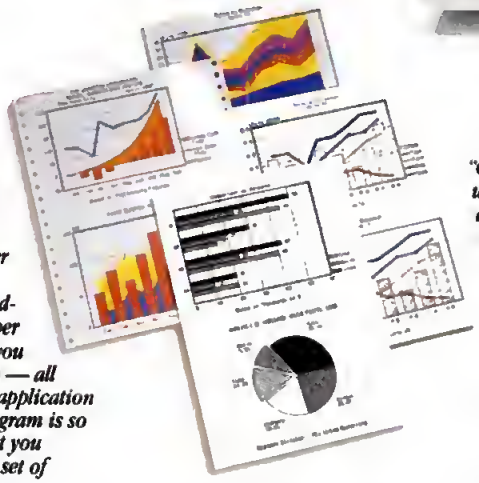


Graph-in-the-Box™ is the first memory-resident graph generator. It captures data from virtually any application running, and displays or prints graphs in seconds.



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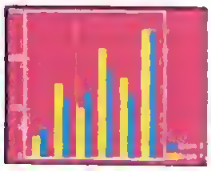
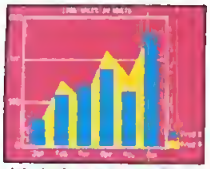
One keystroke wakes up Graph-in-the-Box during any other application. Just pass the cursor over any numbers to "capture" them from the screen...



2

and press ENTER to see them displayed as a simple column graph.

3



Capture text for labels the same way. Then you can view the finished graph in eleven different formats (line, pie, etc.) at the touch of a key. Display, save, and print Instant Graphs in just seconds.

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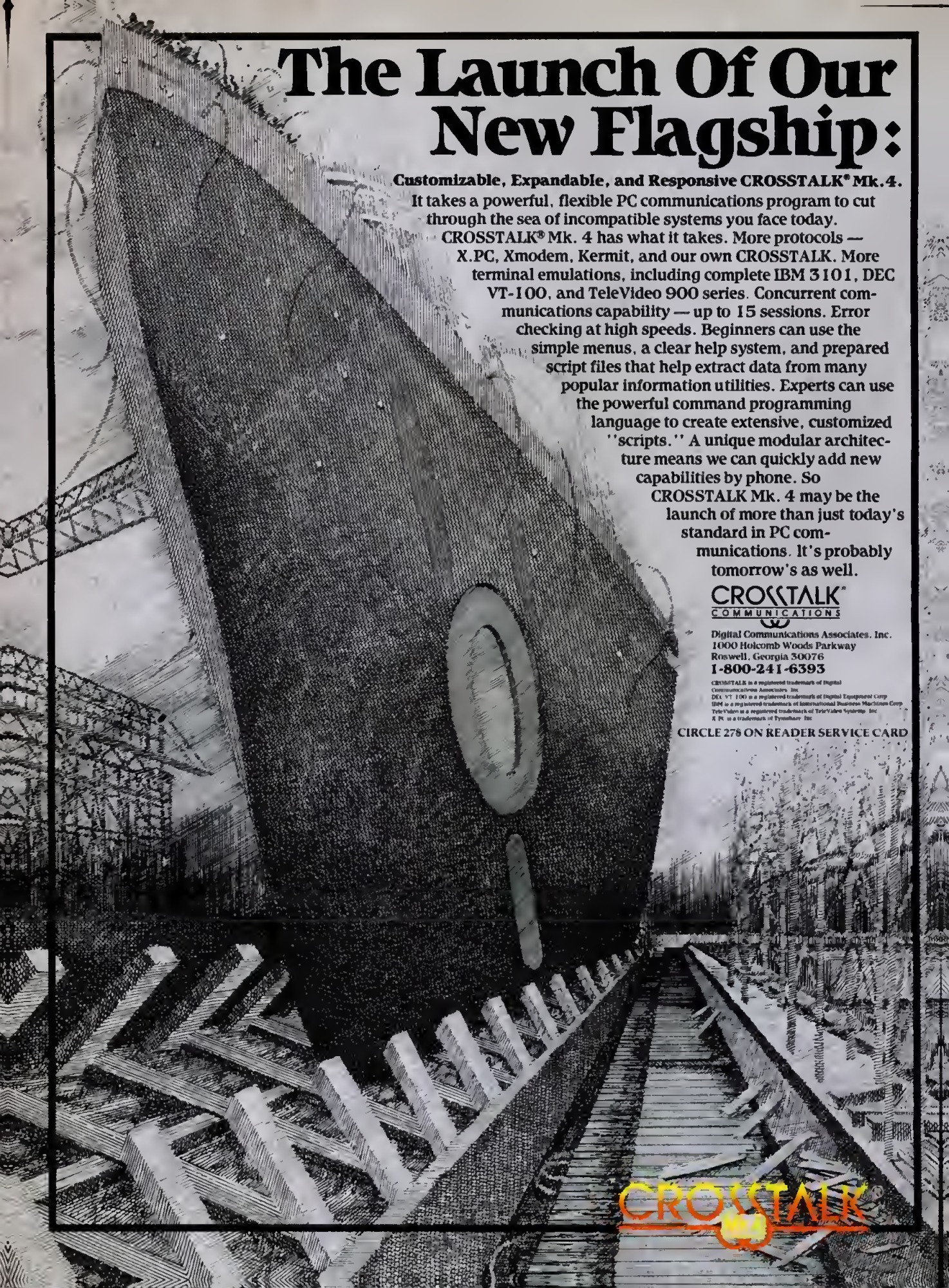
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■ JIM SEYMOUR

COMPUTERS IN OUR HOMES

Most talk about home process control is far off the mark. What's needed is some serious thinking about what's possible 20 years from now.

Most of the time we at *PC Magazine* focus on how PC users can put their machines to work *at* work. But the uses of PCs go far beyond the spreadsheets, word processing, and other business applications most of us rely upon. Those other ways PCs can contribute to our lives—in our homes and at our leisure—are important, too.

At the same time, few areas of personal computer applications have had so much out-and-out garbage written about them as the uses of PCs in the home. Particularly about using computers to *run* your home.

I keep bumping into well-meaning people who are convinced we'll soon be running our houses—including all the systems of those houses, from heating and air conditioning to lighting, security, telecommunications, and the rest of it—from an IBM PC tucked under the stairs.

SMART APPLIANCES Both direct experience and a look at what's happening in the microprocessor market persuade me that's exactly wrong. We're not going to run our homes with our PCs. They're lousy tools for the job. We *are* going to have lots of very smart, computer-like appliances and systems with their own discrete, built-in computers doing the job. And doing it a lot better.

These "smart systems" are already moving into our homes in great numbers. Walk through a new house and you'll find 20 or 30 microprocessors at work in thermostats, alarm systems, lighting controllers, refrigerators, dishwashers, and many other unexpected places.

SMARTER HOUSES But the very discreteness of these many systems, and the crippling lack of interaction among them, suggests this is just a phase, though one we'll be stuck in for another decade, as we concentrate on ever-smarter boxes rather than focusing on the real challenge: smarter *houses*.

I've thought about this a lot recently, following a long talk about the future of architecture with Charles Harker. Harker is a distinguished architect and visiting professor at Kent State University, and he designed my new home.

Peeling back the layers of the minds of very good people in any profession is a fascinating exercise and, as I've gotten to know Harker better, I've been intrigued by the connections his mind makes between the literal and the abstract, between the mundane and the exotic. Like the best people in most fields, Harker (as it happens, an avid PC user) has developed a cohesive philosophy of his work, in which he sees houses as womb-like centers, highly evolved and adapted to meet our emotional as well as physical needs.

Harker noted how trivial are our present conceptions of how computers could be used to control our homes. "It's not just turning things on and off," he said, "with coffee ready when you wake up or the driveway lights turning on at dusk.

"What we need to think about is how in 20 years we'll be using computers to create and *change* our home environments, because these will be interactive systems."

Harker envisions homes in which very smart central computer systems connected to sophisticated sensors detect our presence—and *do* something about that presence, acting on their own according to a matrix of rules about our preferences and our needs.

SENSITIVE SYSTEMS "Say you come in after work, in late afternoon. The system senses your return, and it senses your mood—how, I don't know, some kind of emotional sensors, maybe. Say you're tense, angry. The system starts very subtly changing the color of the light in the house, washing walls with indirect light in soothing colors. Music, or maybe just sounds, come up as you move through the house.

"The system has learned that you respond well to one set of stimuli when you're in one mood, to another when you feel different. It has learned—and I mean *learned*, through the use of some kind of 'learn mode,' like software—what you

Illustration: Darryl Lagasan

■ JIM SEYMOUR

want, and what you need to get there.

"The house takes care of you."

But it gets better.

"Imagine then that this system, which is going to have to have a *lot* of memory, constantly accumulates this information about you, your wants and needs. After a few years, that house *knows* you."

And once the house knows you, what happens when you move?

"When you move, you can just unplug that chunk of memory, solid-state or whatever we're using then, and take it with you. In your new home, you plug it into the control system in the new house, and instantly *that* house knows all about you—10 or 20 years of accumulated, ever-changing and growing, finely calibrated information about you, your needs and preferences."

HAL OR BLUE SKY A lot of people are put off by that kind of thinking. Some say that it's ridiculously blue-sky; others find it a little frightening and say they hear *2001*'s HAL ominously mumbling somewhere in the background.

The first group tends to focus on the practicality of the idea: "Why, we don't have any sensors like that. And what about power outages? And we don't have any kind of standard connectors or chassis-buses to plug that memory into when you move." The latter shrink from the idea itself into a welter of philosophical objections: "I don't want any machine knowing me that well. I don't want that kind of mechanistic intrusions on my life." And, "Sometimes when I'm mad, I want to *stay* mad!"

■ Our homes will be interactive systems in which very smart computers detect our presence and *do* something about that presence according to our needs.

Both miss the point: by seeing not just what's possible today, but by thinking hard about *what we want to be possible* tomorrow, we can use the power of computers—almost certainly in the form of whatever kind of PCs we're using a decade or two hence—to remake our worlds, reaching beyond personal productivity to personal development and satisfaction. PC

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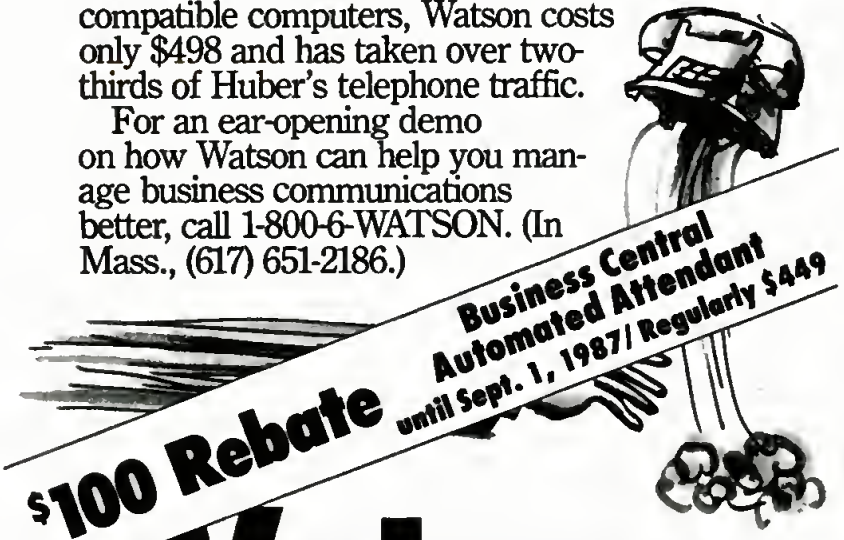

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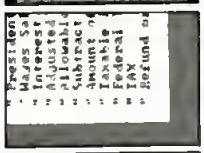

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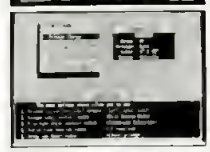

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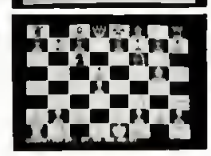

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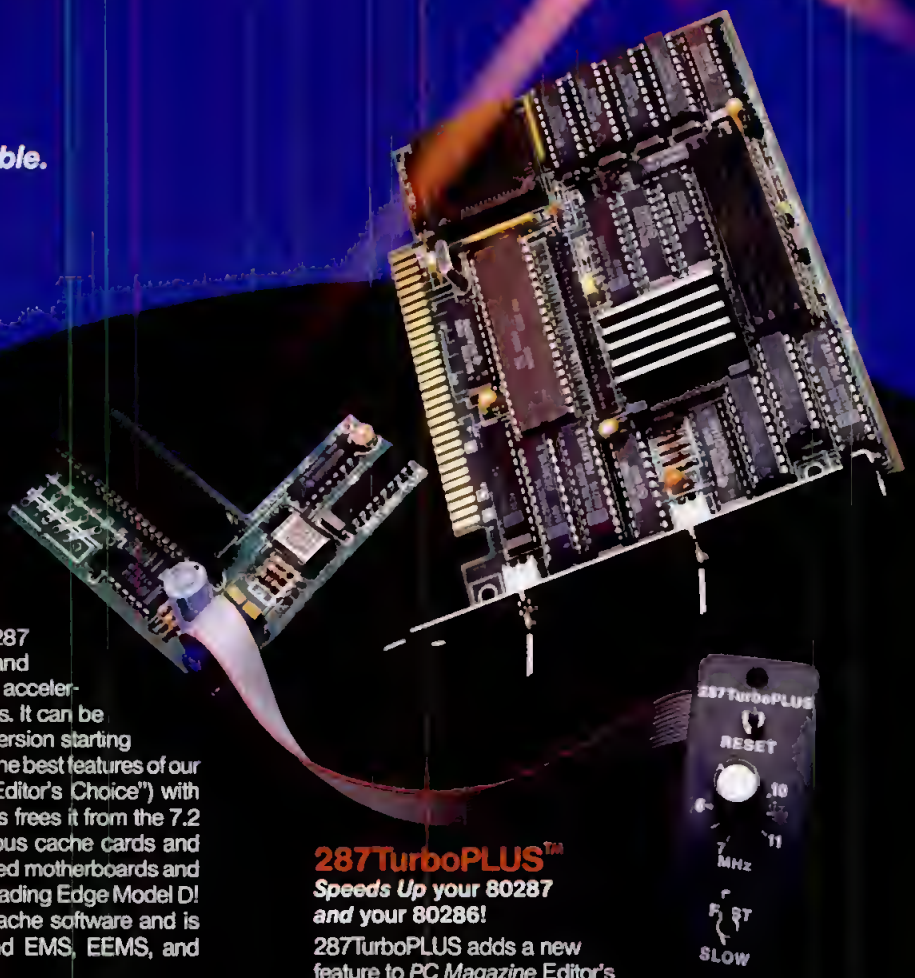

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High Resolution Monochrome Monitor
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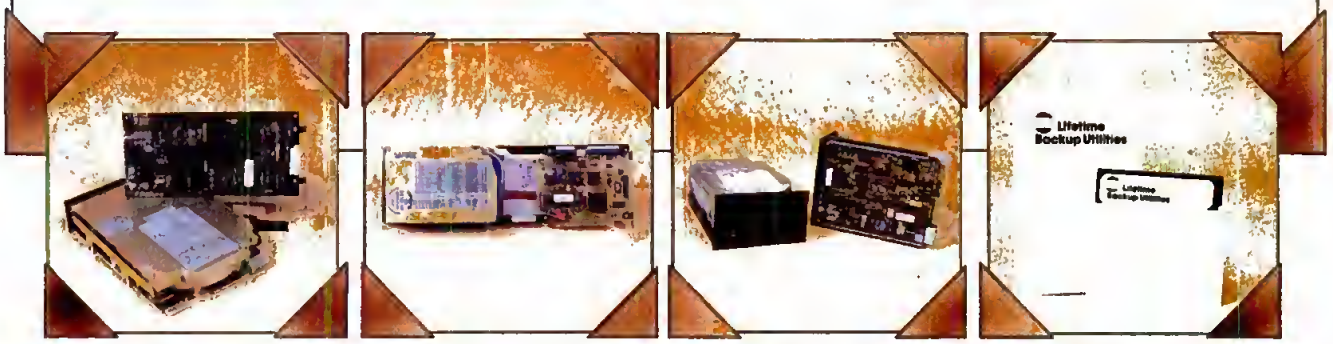

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■ STEPHEN MANES

PS/2 TOP TEN LISTS

From the Home Office in Scottsdale, Arizona (with apologies to the staff of "Late Night with David Letterman," and we all know just how painful that can be).

Top Ten Advantages of the Personal System/2

10. New bus frees old-model expansion cards for use as attractive, functional coasters.

9. Icon that appears when you boot up with a nonsystem disk by mistake does not have a "grumpy face."

8. Integral card labels make accidental installation of multiple mouse boards unlikely.

7. Faster serial port means no more problems with your 19,200-bps modem.

6. Three-slot design of low-end models eliminates overheating worries.

5. Extra-wide standard keyboard keeps your desk from looking empty.

4. Snappy design makes underlings with plain old PCs feel like wienies.

3. On-board graphics lets monochrome users goof off with paint programs.

2. Handle on high-end models whisks thieves out of your office fast.

1. Snazzy new IBM nameplate is "virtually impossible to clone."

Top Ten Disadvantages of the Personal System/2

10. Decreased RF may eliminate soothing rhythmic pulsations from FM radio band.

9. Fan is so quiet the boss won't believe you're doing your job.

8. 5¼-inch floppies won't fit into new disk drives unless you fold them with special optional tool.

7. Thumbscrew connectors and elimination of internal switches presage plummet in needle-nose pliers industry.

6. Lower-temperature operation may spell need for space heater.

5. "A platform for the future" motto refers only to high-end model and IBM profitability.

4. Snappy design lets boss instantly single out office spendthrifts.

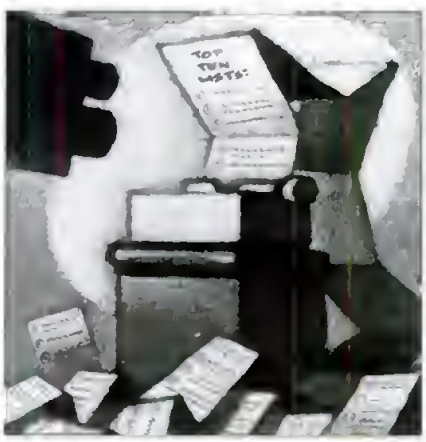
3. Desirable configuration and price available from IBM only after traditional 18-month wait.

2. Higher reliability creates fewer opportunities for days off.

1. Cassette port not even offered as an option.

Top Ten Nicknames for Personal System/2 Machines

10. Slash Two.
9. Leading Edge Model E.
8. PS I Love You.
7. PS de Resistance.
6. PS Your Cat Is Dead.
5. Virgule II.



4. Deskpro Plus.
3. The Buddy System.
2. PS Zadora.
1. That new IBM PC—you know, the one that won't take the old cards.

Top Ten Rejected Spokespersons for Personal System/2

10. Original cast of "The Honeymooners" (except Jackie Gleason).

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Top Ten Exciting New Features of OS/2 or National Pastimes

10. Breaking the 640K barrier.
9. Watching TV.
8. Ogling members of the opposite sex.
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5. Knocking down a few brews.
4. Barbecuing ribs.
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2. Cutting your toenails.
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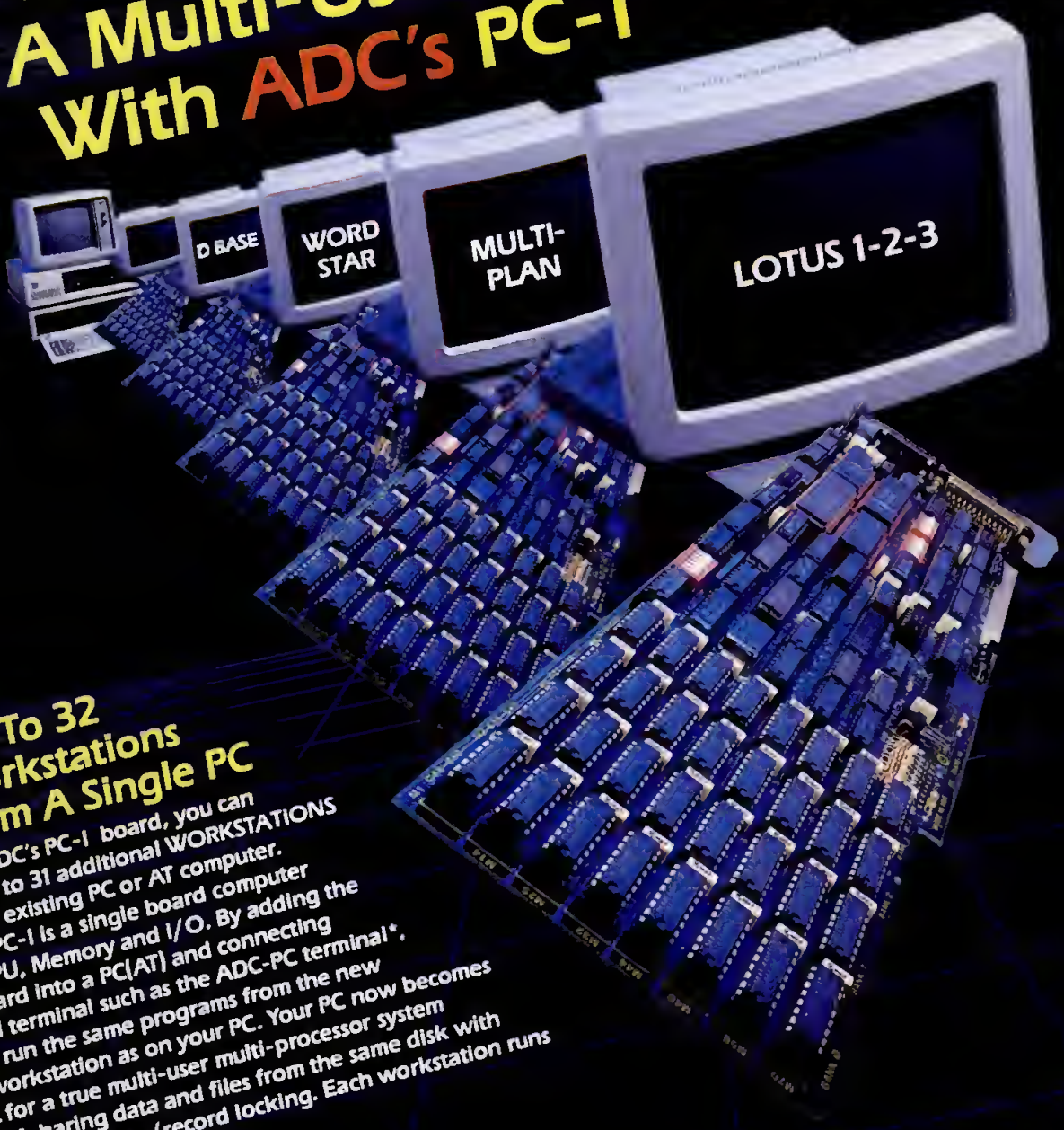

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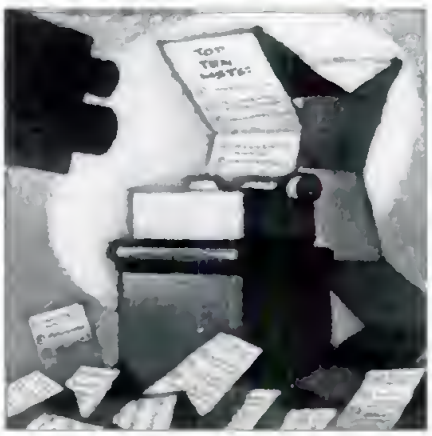

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Illustration: Daryl Lgasan

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■ **STEPHEN MANES**

Top Ten Recent Quotes from IBM or Its Competitors

10. "How could they be so nice? Even *our* 286 machines will run OS/2 (we pray)."
9. "Performance in a multitasking operating system is a function of both the individual program and the total system load as well as the size of the physical system."
8. "Oh, no! A version of *DisplayWrite* so big it has to run in protected mode! How can we possibly compete?"
7. "It's a *very* competitive price. Our brand-new Personal Pageprinter is just $2,199."
6. "Damn! I knew we shouldn't have bet the company on 1.4-meg to 5¼-inch floppy technology!"
5. "Oh, yes, it does need our Personal Pageprinter adapter. But that only costs $1,950."
4. "Just wait. Maybe these new hard disks won't work right for a couple of years, either."
3. "IBM cannot comment on any future releases."
2. "Does this mean The Little Tramp can flack for us?"
1. "We're practically *giving* them away!"

Top Ten Rejected Names for the New IBM Personal System/2 Bus

10. S-200.
9. Byte of the Greyhound.
8. Electric Trailways.
7. Flxible.
6. Magic.
5. Omni.
4. Incu.
3. Succu.
2. Notreallya . . . Morelikcachannel.
1. Blunder.

Top Ten Markets for IBM Personal System/2 or Mr. Coffee machines

10. Trendsetters bored with their Macintoshes.
9. Secretaries.
8. Housewives.
7. Competitors.
6. Developers.
5. Joe DiMaggio's devoted fans.
4. Those who care enough to buy the very best.
3. High rollers.
2. Glamorous movie stars.
1. MIS guys who won't lose their jobs as the result of specifying IBM or Mr. Coffee and . . . what the hey, it's not their dime, anyhow.

Top Ten Things You Can Do with a Personal System/2 that You Can't with Any Other Machine on the Market

[Transmission garbled; the Home Office was out to lunch at deadline.]

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■ STEWART ALSOP

WHAT'S A POWER USER TO DO?

The best things in life don't come easy or cheap. Choosing a top-of-the-line computer that does everything is enough to drive anyone to distraction.

I've got a problem. I've got to buy a new computer. This is a really tough decision right now.

Let me clarify. I don't want just any old wimpy computer. I'm a pundit, after all, and I've got to have the latest and greatest, which means a computer with a 32-bit processor, lots of memory and storage, and powerful software. On that basis, I have four choices.

As I write this column, I can go out and buy a Compaq Deskpro 386. Or I can wait about a month and buy an Apple Macintosh II. Or I can wait until sometime between July and September and buy an IBM Model 80-041. Or I can wait another 3 months and buy an IBM Model 80-111.

If I buy a Deskpro 386 right now, I'll have to spend about $6,500 at list price to get the box, which includes a 16-MHz processor, 1 megabyte of memory, and 40 megabytes of hard disk storage. With a Deskpro 386, I will be able to keep using the high-resolution multiscanning monitor, the multimode graphics board, the modem, network adapter, facsimile board, and expanded memory board I now own.

I will also be able to use the new operating system, OS/2, that IBM and Microsoft have promised to deliver sometime next year in addition to all of the DOS 3.3 software I already have. But when that operating system is delivered, I will have to first wait for and then buy the amazing new applications that are supposed to become available for it sometime in late 1988 or early 1989. In addition, if all the board makers and software developers begin to support the graphics modes and bus of IBM's PS/2 computers, I may run the risk of not being able to use some of those products.

If I wait a month to buy an Apple Macintosh II when it ships, I'll have to spend about $5,500 at list price to get the box, which also includes a 16-MHz processor, 1 megabyte of memory, and 40 megabytes of hard disk storage. I will also have to buy a $1,000 color monitor, a $500 video board, and any other adapter boards I might need (although one network adapter is already built in) when they become available. To be fair, though, since I already own two external hard disks totaling 60 megabytes, I could get away with the floppy-only version of the box for $3,900. That makes the total price about $6,500.

COMPATIBLE APPLE I also know that I will be able to use Apple's new multitasking operating system for the Macintosh, and, unlike with the Compaq or the IBM, I know that virtually all of my old Macintosh software will continue to work with this new operating system. Indeed, if I also wanted to run most of my PC software on the Macintosh, I could combine the two by buying a $1,500 board set and $400 disk drive for the Macintosh that would give me a full-blown, 8-MHz, 80286-based PC that could run the software that's got drivers for the old monochrome and color/graphics adapters.

If I wait until this summer to buy an IBM PS/2 Model 80-041, I will have to spend about $7,000 at list price to get the box, which will include the same processor, memory, and hard-disk storage. Unfortunately, I will also have to spend $600 to get the 14-inch color monitor (since old monitors don't work with the new computers, although the video adapter is now built in), and I will have to replace all of my adapter boards to accommodate the new PS/2 bus, including the modem, network board, memory expansion, and facsimile board, which probably comes to another $3,500 or so. (Unless add-in companies are real quick, I will also have to buy all those cards from IBM, which isn't currently offering a facsimile board.)

Once I've done all of that, though, I will also be able to use most of my existing software (except that which is "timing-dependent": offhand, I can't say which of my programs fits that description). And I know that I will be able to use the new operating system and its new applications and that those applications will probably perform better than they would on a machine like the Deskpro 386.

Illustration: Darryl Lagasan

■ STEWART ALSOP

Last, if I wait until this fall to buy an IBM PS/2 Model 80-111, I will have to spend about $11,000 to get the box, which includes a 20-MHz processor, 2 megabytes of memory, and 115 megabytes of hard disk storage. As with the Model 80-041, I will end up spending a lot of money replacing all of my adapter boards and my monitor and will get the same access to old and new software.

EXPENSIVE CHOICES So there I am, faced with a purchasing decision that could set me back from $6,500 (without access to Macintosh software) to $8,000 (with access to both) to about $11,000 (again without access to Macintosh software) to about $14,000 (for better performance, more storage, but no access to Macintosh software).

What's a power user to do, for gosh sakes? On any of these systems, I will be able to run most of my existing PC software. But only on the Macintosh will I be able to run Macintosh software. (It's important for pundits to know what's going on in other parts of the industry. And, regrettably, many of the fancy new applications that I'm supposed to be able to get on OS/2 already exist on the Macintosh.) But

■ I'm going to have to buy two computers, a Macintosh II and a PS/2 Model 80-041, which will set me back $15,000.

the Macintosh gives me only the possibility, not the assurance, of being able to run the new OS/2 stuff.

Indeed, the sad fact is that, to be sure that I can run software from both environments and still get the whizzy new operating system and coprocessor cards that will run on the new IBM bus, I'm going to have to buy two computers, a Macintosh II and a PS/2 Model 80-041, which will set me back somewhere around $15,000.

It sure is getting expensive to be a pundit. (Does anybody have any spare change?) Of course, I could always stick with my wimpy old computers, get a real job, and let IBM, Apple, and Compaq fight it out for another year or so. That way I can wait for all this operating system stuff to sort itself out and then go out and buy the one computer that will do everything I want. But then I couldn't be a pundit anymore, and it's too much fun writing these crazy columns. PC

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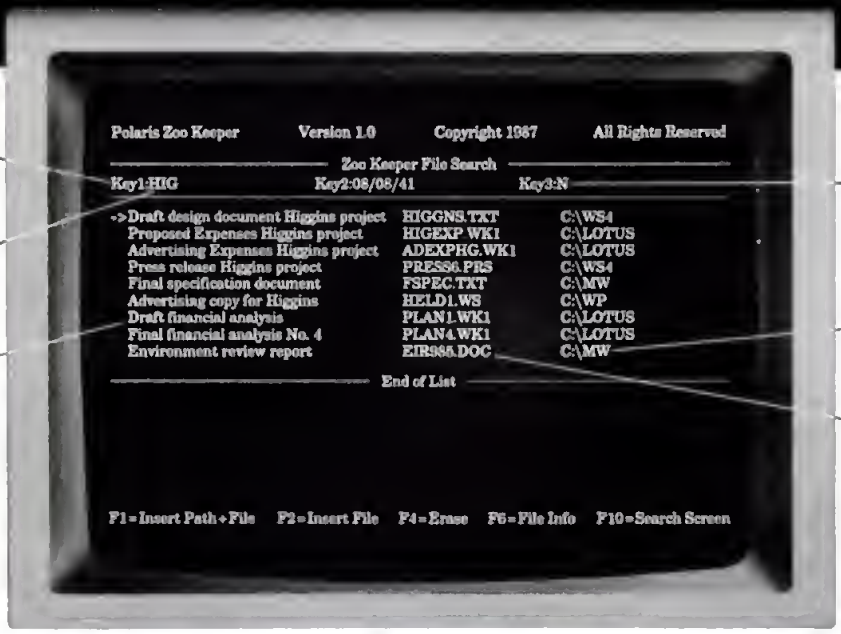

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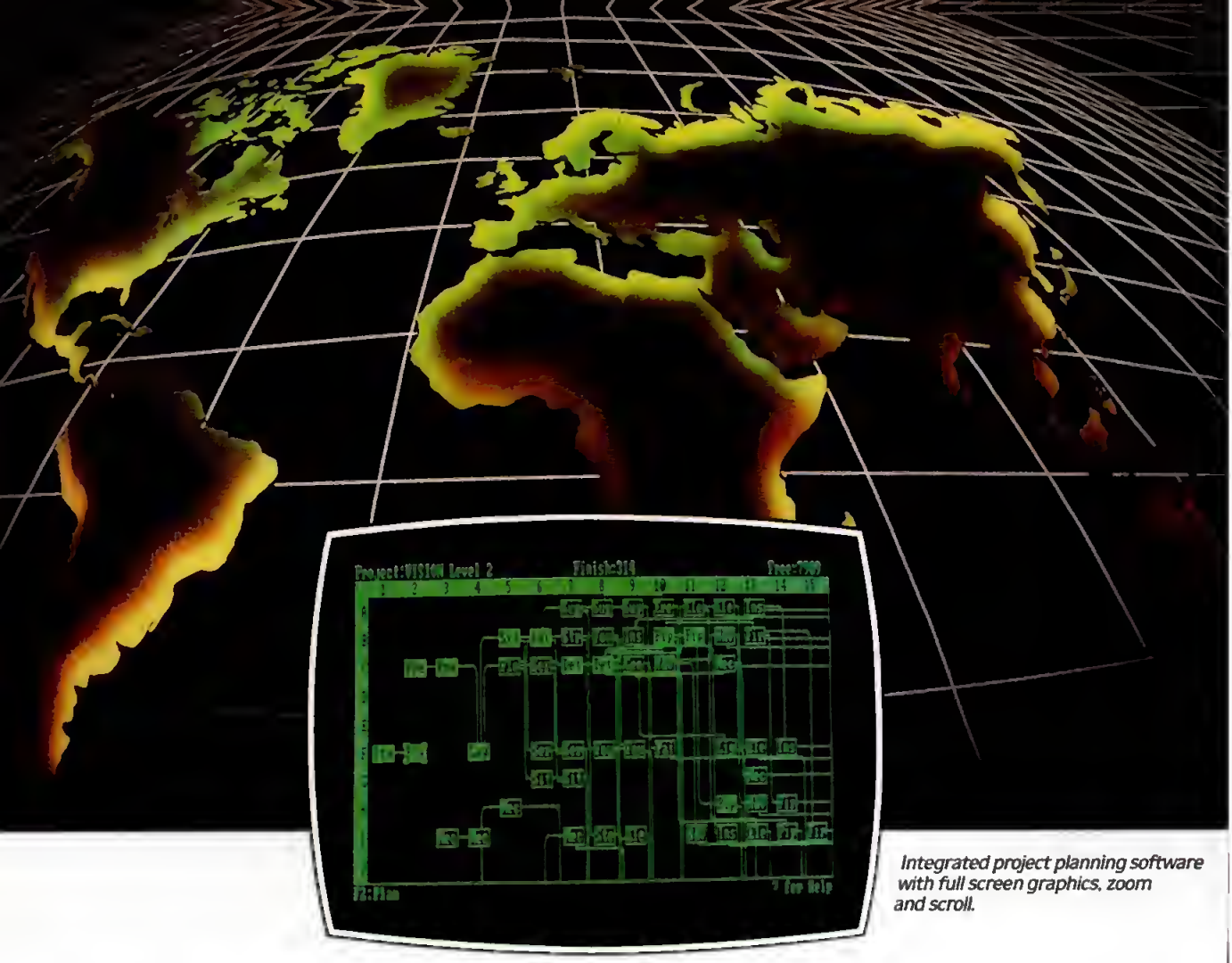

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TABLE OF BENCHMARK RESULTS

This table shows the results of the processor/coprocessor speed tests using the April 1986 release of PC Magazine's 'PC Labs Benchmark Tests'. These are public domain programs, and are available on diskette from PC Magazine, or via the PC Magazine bulletin board. These results were obtained by us at PCSG, and are not yet official published PC Magazine figures.

The last line in the table, the Norton System Information Test, is not from PC Magazine, but is part of the popular 'Norton Utilities.' The version we used was 3.1, which is the latest version but may not give identical results to older versions.

	IBM PC	IBM AT	*BREAKTHRU 286*	
Clock speed in MHz (IBM PC is 4.77)	4.77	6	8	12
Empty Loop	1	1.99	3.34	5.15
Integer add from memory	1	3.35	4.41	6.02
Integer multiply from memory	1	6.06	6.55	8.3
Floating point without coprocessor	1	3.33	4.42	5.76
Prime number test	1	1.95	2.85	3.7
Lotus 123 macro (640K)	1	2.64	3.69	4.62
Lotus 123 macro (256K)	1	1.77	3.54	4.38
Norton System Information Test	1	5.73	7.34	10.2

In every case but clock speed the numbers indicate how many times faster a test is performed than on a regular IBM PC.

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I've got a problem. I've got to buy a new computer. This is a really tough decision right now.

Let me clarify. I don't want just any old wimpy computer. I'm a pundit, after all, and I've got to have the latest and greatest, which means a computer with a 32-bit processor, lots of memory and storage, and powerful software. On that basis, I have four choices.

As I write this column, I can go out and buy a Compaq Deskpro 386. Or I can wait about a month and buy an Apple Macintosh II. Or I can wait until sometime between July and September and buy an IBM Model 80-041. Or I can wait another 3 months and buy an IBM Model 80-111.

If I buy a Deskpro 386 right now, I'll have to spend about $6,500 at list price to get the box, which includes a 16-MHz processor, 1 megabyte of memory, and 40 megabytes of hard disk storage. With a Deskpro 386, I will be able to keep using the high-resolution multiscanning monitor, the multimode graphics board, the modem, network adapter, facsimile board, and expanded memory board I now own.

I will also be able to use the new operating system, OS/2, that IBM and Microsoft have promised to deliver sometime next year in addition to all of the DOS 3.3 software I already have. But when that operating system is delivered, I will have to first wait for and then buy the amazing new applications that are supposed to become available for it sometime in late 1988 or early 1989. In addition, if all the board makers and software developers begin to support the graphics modes and bus of IBM's PS/2 computers, I may run the risk of not being able to use some of those products.

If I wait a month to buy an Apple Macintosh II when it ships, I'll have to spend about $5,500 at list price to get the box, which also includes a 16-MHz processor, 1 megabyte of memory, and 40 megabytes of hard disk storage. I will also have to buy a $1,000 color monitor, a $500 video board, and any other adapter boards I might need (although one network adapter is already built in) when they become available. To be fair, though, since I already own two external hard disks totaling 60 megabytes, I could get away with the floppy-only version of the box for $3,900. That makes the total price about $6,500.

COMPATIBLE APPLE I also know that I will be able to use Apple's new multitasking operating system for the Macintosh, and, unlike with the Compaq or the IBM, I know that virtually all of my old Macintosh software will continue to work with this new operating system. Indeed, if I also wanted to run most of my PC software on the Macintosh, I could combine the two by buying a $1,500 board set and $400 disk drive for the Macintosh that would give me a full-blown, 8-MHz, 80286-based PC that could run the software that's got drivers for the old monochrome and color/graphics adapters.

If I wait until this summer to buy an IBM PS/2 Model 80-041, I will have to spend about $7,000 at list price to get the box, which will include the same processor, memory, and hard-disk storage. Unfortunately, I will also have to spend $600 to get the 14-inch color monitor (since old monitors don't work with the new computers, although the video adapter is now built in), and I will have to replace all of my adapter boards to accommodate the new PS/2 bus, including the modem, network board, memory expansion, and facsimile board, which probably comes to another $3,500 or so. (Unless add-in companies are real quick, I will also have to buy all those cards from IBM, which isn't currently offering a facsimile board.)

Once I've done all of that, though, I will also be able to use most of my existing software (except that which is "timing-dependent": offhand, I can't say which of my programs fits that description). And I know that I will be able to use the new operating system and its new applications and that those applications will probably perform better than they would on a machine like the Deskpro 386.

Illustration: Darryl Ligasan

■ STEWART ALSOP

Last, if I wait until this fall to buy an IBM PS/2 Model 80-111, I will have to spend about $11,000 to get the box, which includes a 20-MHz processor, 2 megabytes of memory, and 115 megabytes of hard disk storage. As with the Model 80-041, I will end up spending a lot of money replacing all of my adapter boards and my monitor and will get the same access to old and new software.

EXPENSIVE CHOICES So there I am, faced with a purchasing decision that could set me back from $6,500 (without access to Macintosh software) to $8,000 (with access to both) to about $11,000 (again without access to Macintosh software) to about $14,000 (for better performance, more storage, but no access to Macintosh software).

What's a power user to do, for gosh sakes? On any of these systems, I will be able to run most of my existing PC software. But only on the Macintosh will I be able to run Macintosh software. (It's important for pundits to know what's going on in other parts of the industry. And, regrettably, many of the fancy new applications that I'm supposed to be able to get on OS/2 already exist on the Macintosh.) But

■ I'm going to have to buy two computers, a Macintosh II and a PS/2 Model 80-041, which will set me back $15,000.

the Macintosh gives me only the possibility, not the assurance, of being able to run the new OS/2 stuff.

Indeed, the sad fact is that, to be sure that I can run software from both environments and still get the whizzy new operating system and coprocessor cards that will run on the new IBM bus, I'm going to have to buy two computers, a Macintosh II and a PS/2 Model 80-041, which will set me back somewhere around $15,000.

It sure is getting expensive to be a pundit. (Does anybody have any spare change?) Of course, I could always stick with my wimpy old computers, get a real job, and let IBM, Apple, and Compaq fight it out for another year or so. That way I can wait for all this operating system stuff to sort itself out and then go out and buy the one computer that will do everything I want. But then I couldn't be a pundit anymore, and it's too much fun writing these crazy columns.

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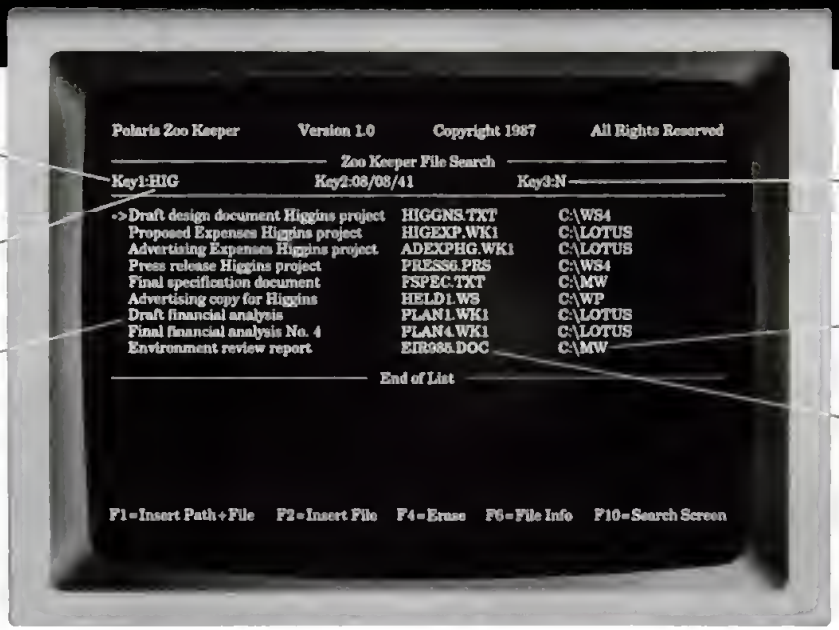

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When you've popped-up your selected file name list, just put the cursor on the one you want to load, touch (enter), and you're in business. And you can also use **Zoo Keeper** to check file contents for removing outdated listings. Simply check the displayed descriptions, point to the ones you want to cull out of the herd (**Zoo Keeper** will compile them in a separate list for confirmation) and zap them with a single command. Quick. Easy. Efficient.

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TABLE OF BENCHMARK RESULTS

This table shows the results of the processor/coprocessor speed tests using the April 1986 release of PC Magazine's 'PC Labs Benchmark Tests'. These are public domain programs, and are available on diskette from PC Magazine, or via the PC Magazine bulletin board. These results were obtained by us at PCSG, and are not yet official published PC Magazine figures.

The last line in the table, the Norton System Information Test, is not from PC Magazine, but is part of the popular 'Norton Utilities.' The version we used was 3.1, which is the latest version but may not give identical results to older versions.

	IBM PC	IBM AT	*BREAKTHRU 286*	
Clock speed in MHz (IBM PC is 4.77)	4.77	6	8	12
Empty Loop	1	1.99	3.34	5.15
Integer add from memory	1	3.35	4.41	6.02
Integer multiply from memory	1	6.06	6.55	8.3
Floating point without coprocessor	1	3.33	4.42	5.76
Prime number test	1	1.95	2.85	3.7
Lotus 123 macro (640K)	1	2.64	3.69	4.62
Lotus 123 macro (256K)	1	1.77	3.54	4.38
Norton System Information Test	1	5.73	7.34	10.2

In every case but clock speed the numbers indicate how many times faster a test is performed than on a regular IBM PC.

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We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC magazines's Best of 1986 award (see box). After the smashing success of Lightning, we developed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.2 times faster than an IBM PC.

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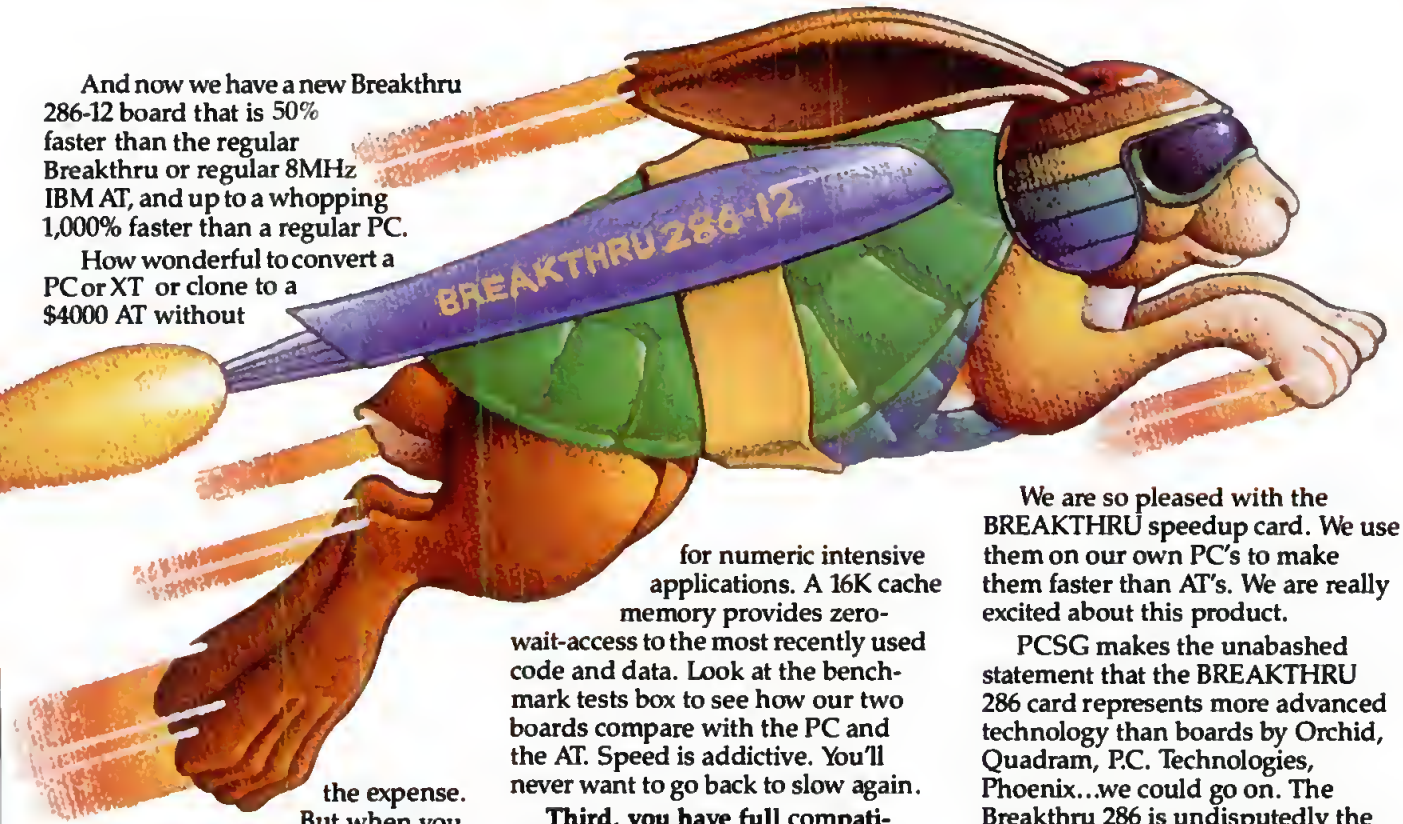
Turn back for test results

IBM PC Speedup Boards



And now we have a new Breakthru 286-12 board that is 50% faster than the regular Breakthru or regular 8MHz IBM AT, and up to a whopping 1,000% faster than a regular PC.

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Second, it is advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. You have your choice of 8MHz at $395 or 12 MHz at $595. You can plug in an optional 80287 math coprocessor chip for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Look at the benchmark tests box to see how our two boards compare with the PC and the AT. Speed is addictive. You'll never want to go back to slow again.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Lotus/Intel/Microsoft Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Fourth, these are the best. There are several other boards on the market. We at PCSG have compared them all, but there simply is no comparison. What we discovered is that many cards being sold offer only a marginal speedup in spite of their claims and others are just poorly engineered. For example some boards have a cumbersome mechanical switch for going back to 8088 speed, but the Breakthru boards have speed switching software that allows you to drop back to a lower speed on the fly for timing sensitive applications. The 8MHz BREAKTHRU 286 and the 12MHz are unequivocally the best executed and most completely reliable speedup boards manufactured today.

We are so pleased with the BREAKTHRU speedup card. We use them on our own PC's to make them faster than AT's. We are really excited about this product.

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IBM's BOLD NEW MOVE

Burned by too many quarters of losing market share, losing revenues, losing its leadership and generally losing face, The Empire Finally Struck Back: IBM has introduced its new line of personal computers.

Though the Personal System/2 machines have both a good deal of sizzle and the smell of success about them, IBM's prices remain high—especially for machines whose

■ ■ ■ ■ ■

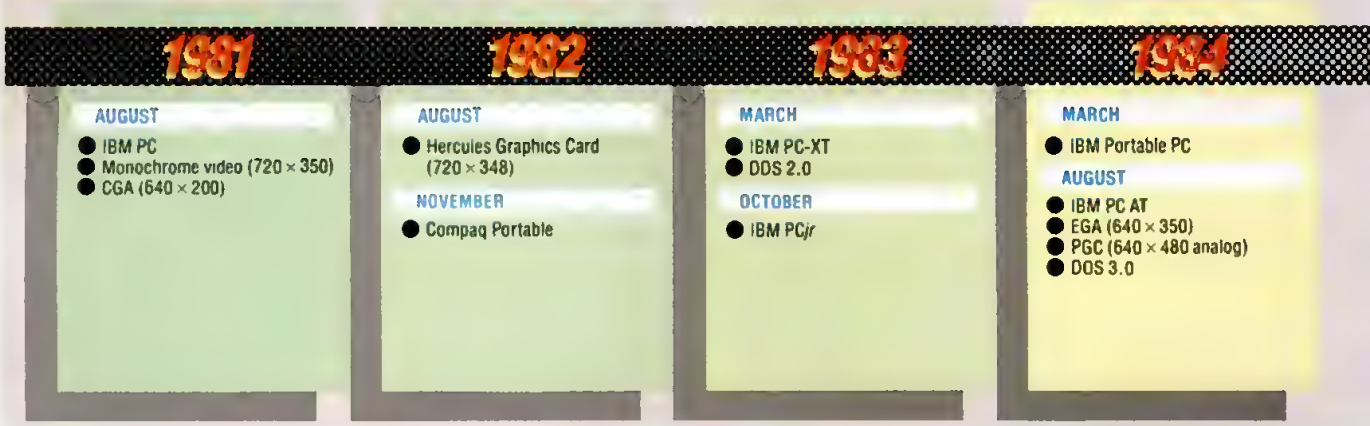
IBM's Personal System/2 line has the smell of success, but is it too late for the company to regain control of the market? Big Blue is betting many will follow its giant step.

Photograph, Roberto Brosan

PC Product Developments: Past, Present, and Future

The PS/2 announcements were IBM's biggest since the original PC arrived 5½ years ago. IBM's other highlights were the PC-XT in March 1983 and the AT and the EGA card in August 1984.

Still to come: OS/2, the operating system that turns the AT and the 286/386 PS/2s into serious computers.



most important new features are as yet largely inaccessible, and ignored by present software. If the new Models 30 and 50 are seen as replacements for existing PC-XTs and PC ATs, IBM's PS/2 price tags look a little better. But only a little. And only if you exclude the rest of the PC-compatible universe.

In an era of $1,000 10-MHz AT clones, it's hard to get too excited about a $3,295 AT-successor from IBM. Until, of course, that new Micro Channel bus comes into its own—and until we get the new Operating System/2 and companion applications programs that should unlock, finally, the protected-mode mysteries of the 80286 chip.

Then, some say, there's going to be blood in the streets. Maybe. To be sure, the importance of the new Micro Channel bus would be hard to overstate. After almost 6 years of wrestling with the limited bus of the original PC, the concurrency available on the new bus—especially in concert with the interprocess communications promised when IBM's more-or-less proprietary extensions to OS/2 become available sometime next year—should delight PC hardware and software designers.

Because the new bus can handle several jobs at once, rather than the one-at-a-time approach of the old PC bus, effective computing-speed improvements well beyond those presently visible in the new machines should be possible. IBM has historically referred to the intermachine communications subsystems of its larger computers as "channels," and it seems clear that the new Micro Channel bus in the PS/2 PCs, which allows much more sophisticated data-handling within the computer, will be exploited by IBM in succeeding product announcements dealing with improved "connectivity" between its PCs and larger mini and mainframe computers.

So, nice going, R&D.

What else is promising, or least interesting? Squeezing the Models 30 and 50 into civilized, small-footprint boxes is important, especially the really small Model 50, which looks *right*, somehow, for a desktop computer.

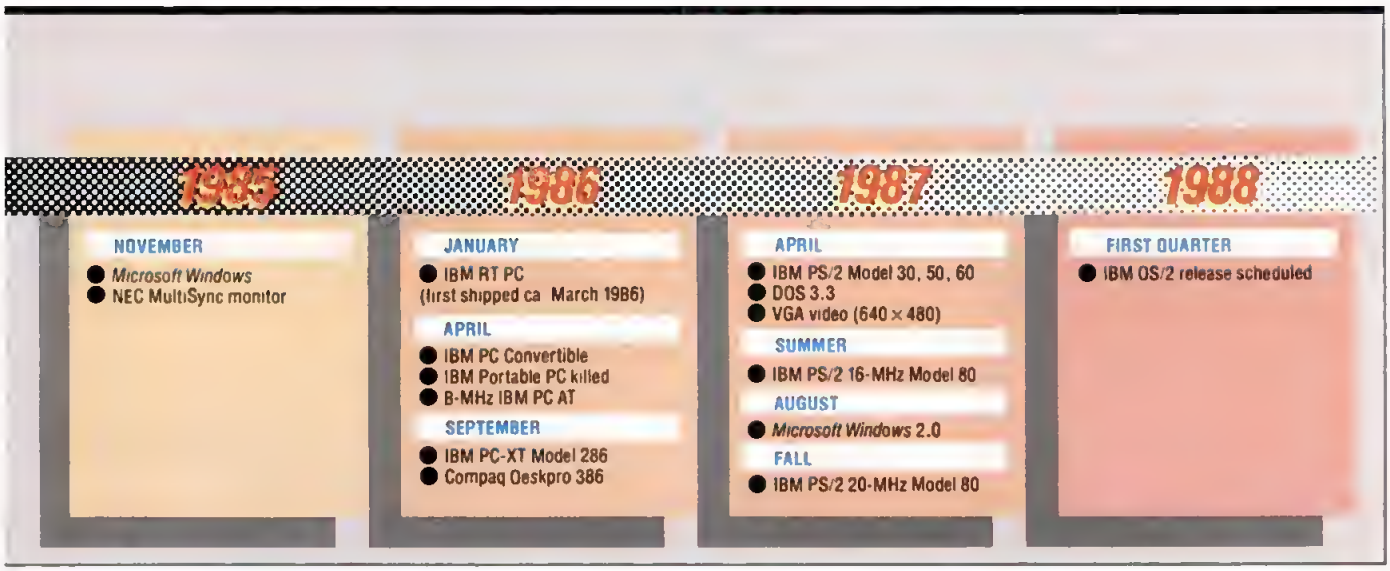
One of the minor mysteries of the new line is the Model 30, which, although allowed to carry the escutcheon of the new line, is really a high-style bridge product from old to new, yesterday to tomorrow—or maybe, 'til midafternoon today. Although it has the look and size of the new PS/2s, there's no Micro Channel bus—only the old-style PC bus.

Actually, the $1,695 two-floppy Model 30-002 makes a nice little *de facto* dedicated word processor. And IBM uses the hard-disk-equipped Model 30-021 with the new 8503 long-gray-scale black-and-white monitor as the platform for an $8,500 desktop publishing system built around Aldus's *PageMaker* and including IBM's tiny new laser printer, which is at least a nice positioning exercise up against Apple's Mac-based $10,000 desktop publishing systems.

TO HAVE—OR HAVE LESS? *PC Magazine* editor Bill Machrone has for some time been saying that, with 80286 PCs and the (perpetually) pending release of a version of an operating system that can address lots of memory in protected mode, IBM and Microsoft are creating a world of Haves, with '286/'386 PCs; and Have Lesses, stuck with 8088/8086 machines. Introducing a nice but limited machine such as the Model 30 may add a new category: the Been Hads.

Buyers eyeing that 8-MHz 8086 chip in the Model 30 should beware of the machine's sludgy hard disk, for which IBM claims an only 80-millisecond access time. IBM has learned its lesson about selling no-drive and one-floppy machines for buyers to fill up with better or lower-priced aftermarket drives: the only way you can buy a Model 30 is with two 3½-inch floppy disks or with one floppy and that retrograde hard disk.

Actually, moving data between the 3½-inch floppies of the new-generation IBMs and the 5¼-inch drives of rest of the IBM-compatible world won't be nearly as difficult as some naysayers predict. Traveling Software's *Lap-Link* package, *The Brooklyn Bridge*, and other low-cost serial-port transfer programs are easy to use for occasional data exchange; if you're



changing formats with any regularity, you'll want an external 5¼-inch drive for the PS/2 machines. And IBM introduced with the PS/2 series an odd but interesting program, *Data Interchange Facility*, which moves data between two PCs using different-size disks via their parallel ports, using a standard parallel printer cable. In any case, floppy disk sizes aren't such a big deal anymore. In an era of hard-disk PCs, we've reduced floppies to software distribution and backup roles.

The technological changes in the PS/2s make sense, though the Rod Canion camp will continue to defend the 5¼-inch floppy—until about 1 minute before they introduce 3½-inch-equipped machines, which won't be long.

SEND IN THE CLONES But what happened to the "clone killer" side of the new IBM line? Sure, it'll take a while for the Phoenix Technologies of the new bus to emerge, but someone's going to bust the bus: it's only a matter of time 'til we see PS/2 clones.

It was the pricing on the new IBM line that was supposed to make the clone shops wither and blow away. Some withering. Some blowing away. Compaq and Tandy have been by far the biggest thorns in IBM's side. Others may be cheaper, others may be more technologically advanced—but Compaq and Tandy have distribution, they have volume, and they have big gross margins. As IBM's newfound attention to its distribution problems shows, IBM understands just how big a role effective distribution plays in building volume. And what nice things volume combined with decent margins does to your balance sheet. Or in this case, to the *other* guys' balance sheets.

It was the pricing on the new IBM line that was supposed to make the clone shops wither and blow away. Some withering. Some blowing away.

But it's hard to see how IBM's new prices—scaling all the way up to $10,995 (sans display) for a 20 MHz 80386 Model 80-111—will put a dent in Compaq or Tandy's sales. Compaq's Deskpro 386 pricing is already competitive with IBM's low-end Model 80s, which in any case won't be available until July. That means IBM has given Compaq almost a year's head start in the 386 PC business—since the introduction of the Deskpro 386 early last September. In this business, that's a *lot* to give away.

And Tandy looks comfortable with its big-volume Model 1000 EXs and 1000 SXs—both priced way below IBM's base Model 30—as well as with its sub-$2,000 Tandy 3000 HL (which IBM cloned with the XT-286) and its Tandy 3000 HD, a full-scale AT clone that can surely come down a long way from its current $4,299 (recently selling at a typical Tandy promotional discount price of $3,595).

The mail-order clone shops are already below even those prices, of course. PC's Limited, for example, sells its 8-MHz AT clone for $1,495, and a 12-MHz AT clone roughly equivalent in real-world throughput to the new IBM PS/2 Model 50 for an IBM-like $3,495—but including an EGA card and monitor. You can bet *those* prices are highly adjustable, too.

IBM seems to have erected a price umbrella over its most dangerous competition, giving them time to milk the cash flow from their current lines and prices a little longer, while they funnel that cash into R&D on how to match or best IBM's new technical wonders.

THE WINNERS' CIRCLE Texans may not smile much under those big hats, but there were a lot of big grins and toasts to

Bang for the Buck

To compare the value of the PS/2 line with other high-performance computers, factors such as CPU speed, memory size, memory speed, disk capacity, and disk access time were weighted and combined; the machines were then ranked in ascending price order. The index shows positioning of the PS/2 line and indicates where opportunities for IBM's competitors may occur.

*Not yet available

continued prosperity in Fort Worth (Tandy), Houston (Compaq) and Austin (PC's Limited) on the day IBM announced the PS/2 machines.

Microsoft, of course, was one of the biggest winners in the PS/2 announcements. The advent of OS/2 (nee "286 DOS" and "DOS 5.0") is important enough. But IBM's acknowledgement that OS/2 would be backward-compatible on PC ATs and XT/286s, combined with Microsoft's assurances that OS/2 would also be available to all their other licensees, means Gates & Friends will get richer still.

Even better for the Puget Sound economy—and for users tired of DOS's crankiness—the Presentation Manager facility within OS/2 is the affirmation of *Windows* as the dominant graphical interface in the PC business. (An IBM spokesman did, however, say at the PS/2 introduction that present *Windows* applications may not run under OS/2's Presentation Manager without "a little migration." Read: You're gonna have to buy new versions of your *Windows*-compatible programs.)

None of this should be read as criticism of IBM. If anything, leaving so much money on the table for the rest of the PC industry, while creating so many rich and promising opportunities for customers through potential technological extension of the "PC standard," was a good and generous step by IBM.

The technical advances in the new IBM models represent genuinely superior engineering. And while to its great credit IBM didn't resort to such clone-countering ploys as embedding fingerprints in the new machines' ROM code to foil competitors, IBM Entry Systems Division president William Lowe promised that the company will "vigorously protect its sizable R&D investment in these new computers" in the courts.

Fair enough, IBM: that's playing it straight down the middle. Good luck finding judges who understand microcode and bus timing.

The Personal System/2 series is surely IBM's boldest move yet in small computer systems—a larger step forward than even the introduction of the first IBM PC in August, 1981, and the trend-setting PC AT in August, 1984.

And the PS/2 pricing, if not low enough to wound very many competitors, is at least within the context of IBM's traditional pricing strategies fairly aggressive, and indicative of a corporate determination to do whatever is necessary to regain leadership in the PC market.

The question that has not yet been answered is whether the dynamics of the PC market have moved beyond even IBM's ability to reassert control, and whether in an acutely price-sensitive marketplace, advanced but as yet largely unexploited technological features combined with moderate prices can edge out very good performance within a much broader technical standard at substantially lower prices. We'll soon find out.

Stay tuned, friends: We are in for a *wonderful* couple of years.

Jim Seymour is a contributing editor of PC Magazine.

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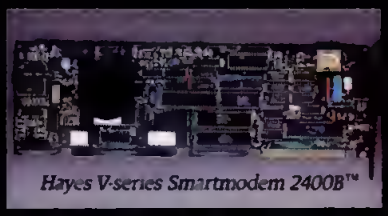
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These modems now represent the new and highest standards for high-speed error-control communications. Using adaptive data compression, they can virtually double throughput up to 19,200 bps and 4800 bps, respectively. And with point-to-point error control, data is sent accurately and reliably. In addition, these modems offer automatic feature negotiation, a self-operating capability that selects the optimum common feature set with any Hayes modem for the most efficient transmissions at the highest shared speed. Synchronous and asynchronous communications modes are also part of the package.

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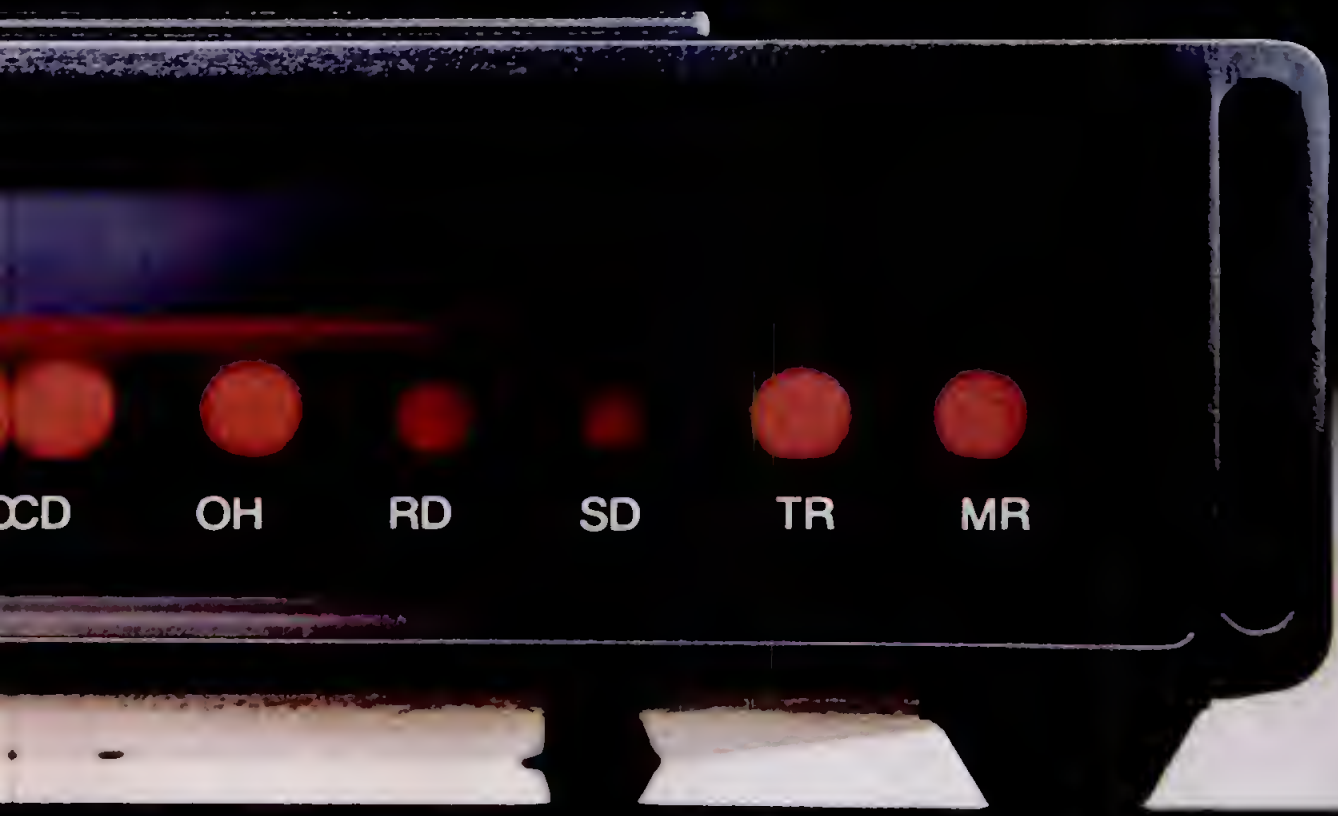
THE V-SERIES MODEMS.



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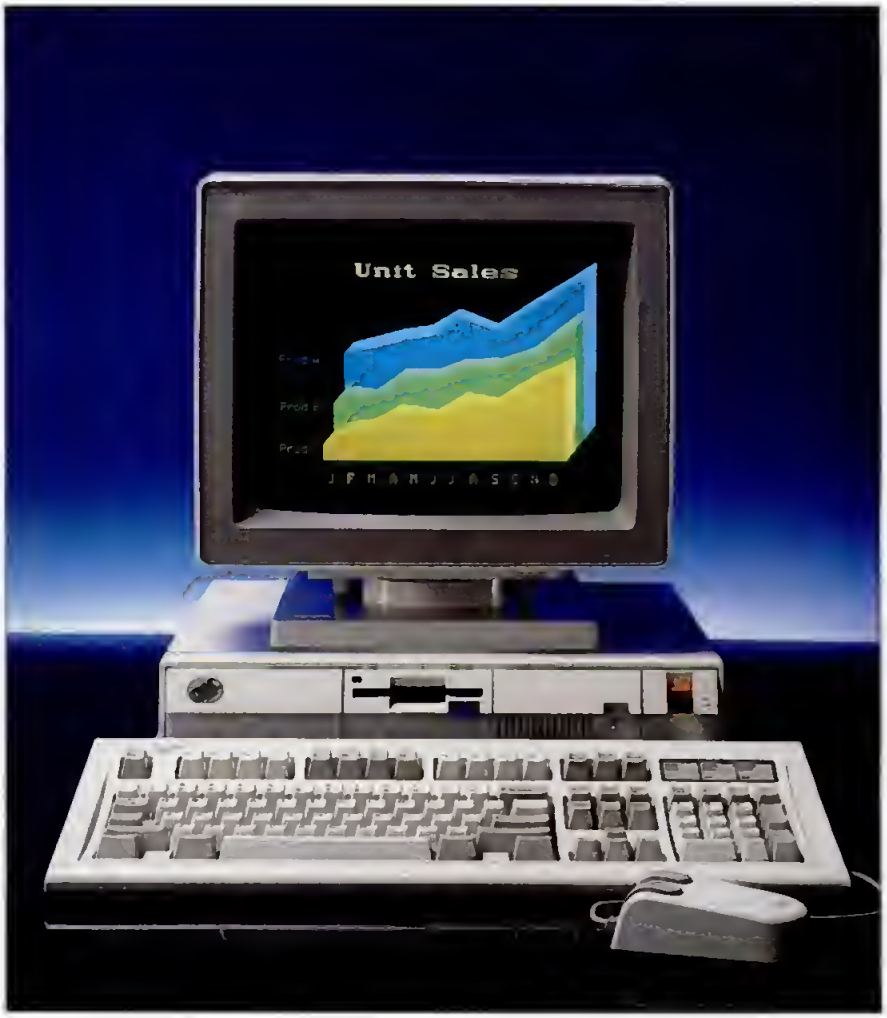
CIRCLE 105 ON READER SERVICE CARD

IBM PERSONAL SYSTEM/2 MODEL 30



The IBM PS/2 Model 30 is based on an 8086 processor that performs just about as fast as the 80286 processor found in an AT. Disk access, however, is sluggish. The Model 30-021, pictured here, comes with one 3½-inch floppy disk drive, a 20-megabyte hard disk, 640K RAM, a graphics controller, and a full-AT-style keyboard. The price is $2,295, not including a VGA-compatible monitor. The dual-floppy-disk model lists for $1,695.

Photograph: Roberto Brosan

The PS/2 Model 30 has something old and something new. Consider it IBM's bridge to the future of personal computing.

The lasting impression you get from the Model 30 is, What took them so long?

IBM says it took hundreds of people working for the past few years to develop the Personal System/2 line. The Model 30 maintains the "16-bit processor on an 8-bit bus" design used in the original PC, XT, and AT. But the blueprints for this machine take advantage of surface-mount and VLSI technologies widely exploited by expansion board manufacturers for 2 years now.

With 640K bytes of RAM, a graphics controller, parallel and serial ports, and both floppy and hard disk controllers on the motherboard, this slim 8-MHz PC has an efficiency of design that makes most of its competitors look as antiquated as a transistor radio in a world of solid-state digital stereo Walkmans.

So why didn't IBM produce this machine a year ago, when it really would have killed a few clones? Answer that question, and you'll solve a puzzle many have asked ever since the PS/2 line was announced in April: What is the purpose of this machine?

The Model 30 is IBM's link to its new world. It's the computer that can help wean the wary away from PC compatibles and get them thinking about the extra power and better graphics available when they're ready for the real next-generation personal computers IBM has announced: the Models 50, 60, and 80.

IBM asks that you forsake 5¼-inch floppies and embrace the 3½-inch 720K-byte disk when you move up to this new line. It also wants you to mothball your digital monitors—MDA, CGA, or EGA—and install one of IBM's new analog displays.

Only then will you be ready for the next generation in personal computing. And if you're not prepared for the major-league investment needed for a Model 60 or 80, you can get the base Model 30, with monitor and at list price, for under $2,000.

You won't be able to run OS/2 when it becomes available next year (the new operating system will only run on 80286-based computers), so you'll always have to live with DOS's 640K-byte limit, but you'll be another step closer to state-of-the-art computing.

THE HEARTBEAT MCGA graphics are at the heart of that strategy. Although the newly introduced display adapter in the Model 30 is based on low-resolution CGA standards, MCGA actually produces a text display that is marginally better than EGA. For everyday chores, it even beats the current crop of so-called better-than-EGA cards now being touted by NEC, Paradise, and Tseng Labs; they can display *Microsoft Windows* and a handful of other programs at 640- by 480-pixel resolution. The Model 30's MCGA text mode brings up ordinary text screens in 640 by 400 resolution, using a character box of 8 by 16 pixels, better than the EGA's 8 by 14, and arguably a toss-up against MDA's 9 by 14. (See Charles Petzold's article, "Triple Standard: Three New Video Modes from IBM.")

Unfortunately, IBM's PS/2 color displays cannot do justice to this enhanced standard. The Model 30's text display is fuzzy at close range. To me, the image is noticeably better than an EGA only at distances of more than 3 feet, where the extra dots in each character improve legibility. At closer distances, however, the characters lack clear definition; they're cloudy.

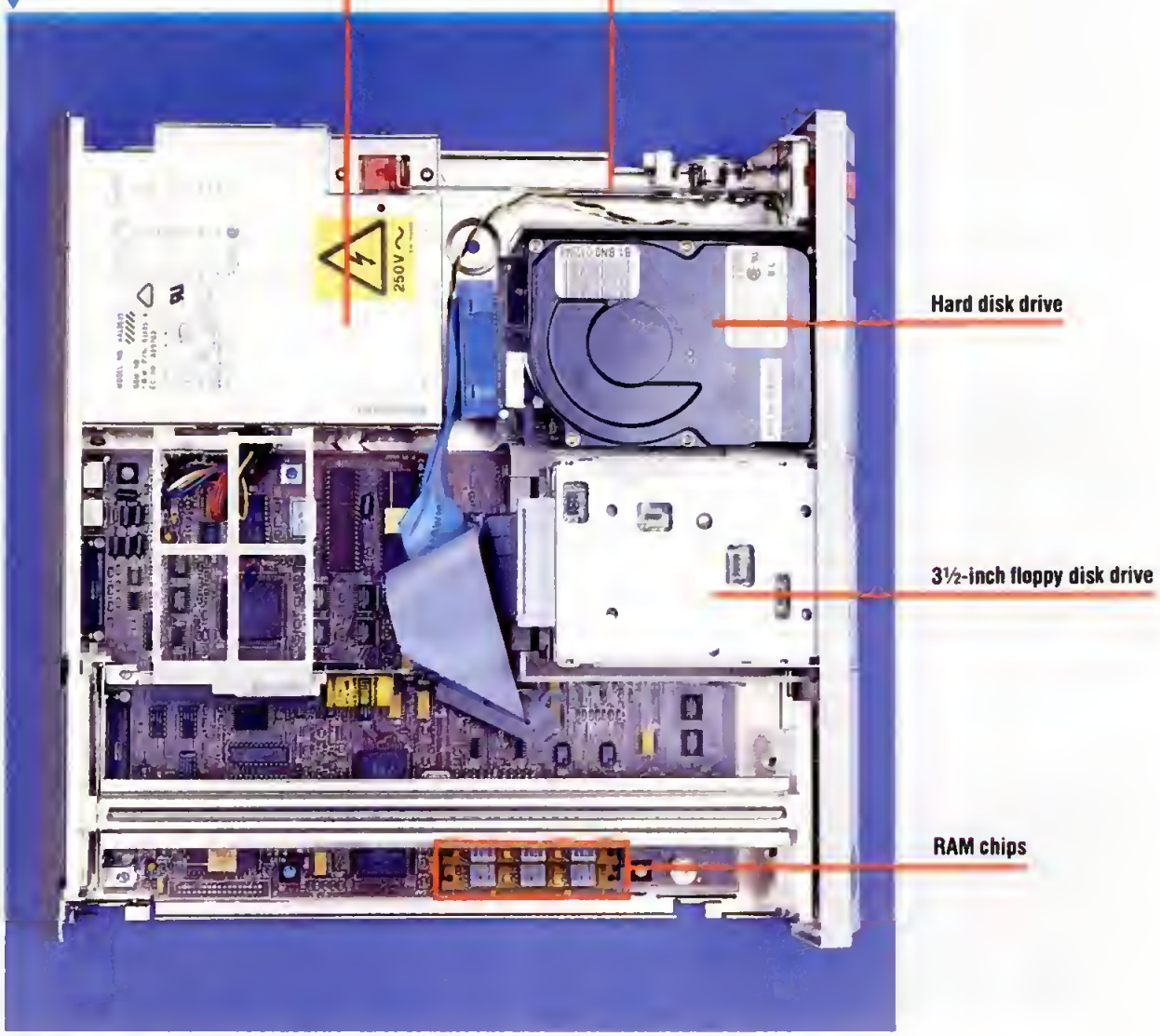
MCGA also provides the most colorful of the new modes in VGA graphics: 256 colors out of a palette of 262,144 at a resolution of 320 by 200 pixels. Right now, most graphics software manufacturers are working overtime to develop programs that realize the potential of this new burst of color.

Everything else about the machine echoes what's gone before and, in most cases, shows a better way of doing it.

Until OS/2 emerges, the Model 30 can deliver enough computing power to run apace with an 8-MHz AT on most chores except disk access. The Model 30's 8086 processor does not have the full range of

PS/2 Model 30

The Model 30 uses an 8086-2 microprocessor that yields AT-class performance. Optimum configuration, shown here, includes one floppy disk, one (slow—80-millisecond access time) hard disk, and 640K RAM (only 512K are visible in this photo). Heavy use of VLSI technology puts ports and controllers on the system board.

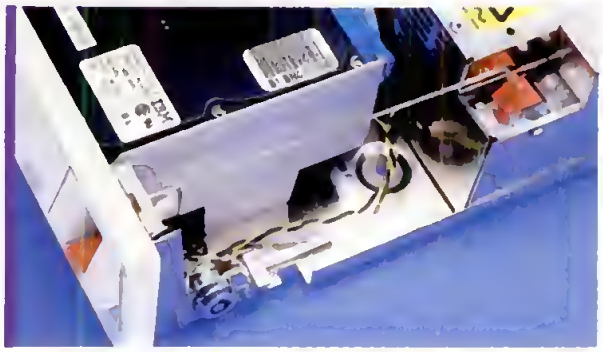


Photographs Thom O'Connor

The Model 30's expansion slots are placed horizontally, parallel to the system board. This saves space and contributes to the machine's 16- by 15.6- by 4-inch footprint.

Expansion slots

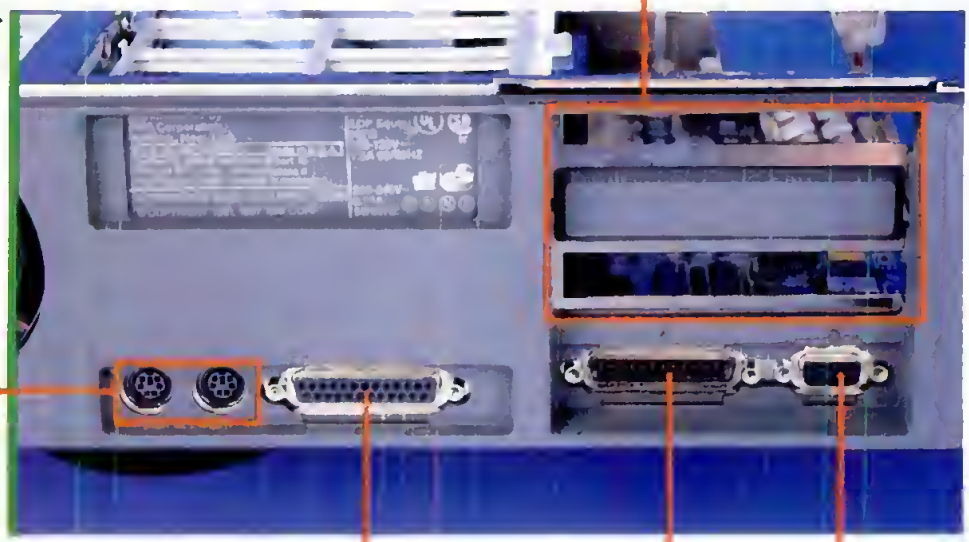
IBM calls this the Generally Operational Linear Digit-Controlled Biphase Electrical Retardance Gate (GOLDBERG—as in Rube), but you can call it the power rod. It connects the big red switch with the power supply.



Power rod

Horizontal expansion slots

The compact back panel of the Model 30 includes interchangeable keyboard and mouse connectors, parallel, serial, and video interfaces, and three horizontal expansion slots.



Interchangeable keyboard/ mouse connectors

Parallel port

Serial port

Video connector

instruction sets supported by an AT's 80286, but it will run most current PC software faster than an 8088-based machine, and roughly as fast as an 8-MHz 80286. The Model 30 lagged behind an AT on pure number-crunching performance tests, but equaled it on string manipulation.

The Model 30 comes in two configurations, a two-disk version (both are 3½-inch, 720K-byte drives) and a hard disk system with a 20-Mbyte drive and one floppy disk drive. None of those disk drives are high achievers. At 80 milliseconds, the 3½-inch hard disk in the Model 30 is only slightly better than the disks IBM installs in XTs, and far behind a stock AT's 40-millisecond hard disk.

The floppy disk drives test at about 300-millisecond access, noticeably slower than the 230-millisecond floppy drives in an XT.

There's little else to criticize about the Model 30. IBM is giving customers almost everything they've been screaming for since the PC was introduced.

The keyboard and monitor cables are a free-wheeling 6 feet long. The on button is right up front, conservatively shielded from accidental brushes by a sloping front canopy. The cover is detached with but four screws that can be easily reached on the machine's sides, so you don't have to disconnect tightly stretched cables and swing the machine around to install a board.

The most merciful of all ergonomic considerations is the complete banishment of jumper switches. All options are software configurable and stored in ROM. There's a battery-powered clock as well.

For the security-conscious, several holes have been drilled into the system unit to readily accommodate bolts. A lock and key is standard on hard disk–equipped machines. Several inches have been shaved on all sides: the Model 30 is 1.5 inches shorter than an AT, 3.6 inches narrower, and 0.5 shallower.

BY THE BOOK Even documentation has been generously improved. A slim handbook replaces the cloth-covered 3-ring binders that did more to obfuscate than elucidate. Purists may object to the condensed instructions; some valuable information is being held back, they may fear. Indeed, whereas IBM once devoted a full page—with a series of illustrations and exploded diagrams—to fully explain the principles involved in keyboard tilt adjustment, nary a sentence appears on the topic in the new manual.

You may have to grapple with such grave issues on your own this time, but I felt more than compensated by the new handbook's concise, clear style. It's a welcome change.

Most people will find installation is easier than on any other computer, although labeling the identical keyboard and mouse ports on the rear panel would save us all from confusing the two.

The new IBM mouse plugs right into the system, rather than through a serial port, but serial and bus mice will still work.

FILLING THE SLOTS Up to three 8-bit XT-compatible expansion boards can plug into the unit's expansion bus, which connects to the system through a card that has three sockets and attaches to the motherboard at a 90-degree angle. It's held in this upright position by a flimsy plastic bracket that extends several inches from the top of the power supply, behind it.

Expansion boards slide into the expansion bus connector card. They are supported on the left by openings in the machine's rear panel that you create by prying off a strip of plastic with a screwdriver. They are supported on the right (if it's a full-length board) by molded slots. It's a shaky system that requires you to mangle the plastic slots IBM has attached to the expansion board's opening on the rear panel. In addition, you are forced to hold the expansion card firmly in place as you slide the board into its connector—a moderately painful experience, thanks to the dozens of sharp wires that protrude from the rear of the expansion bus connector.

While most expansion boards will present no problems, there may be difficulty with some of the more bulky hard disk cards: the expansion bus connector also houses the system's battery and takes up some of the space required by a few hard cards.

With a power supply of 70 watts, the Model 30 uses slightly less than half the power that an XT does (130 watts) and allots 20 watts to power the three slots. That's enough to run most hard cards (which can require up to 13 watts) but it won't leave much for other options you may want to include.

Although there's no current option to do so, RAM expansion may be possible, since 512K bytes of system RAM is removable. Although 128K bytes are soldered to the system board, two 256K-byte banks of IBM's new SIP (Single Inline Package) memory can slide out.

Model 30 owners who envy only the graphics capabilities of the other PS/2 machines have IBM's commitment that a $585 VGA graphics board will soon be available.

IBM's marketing force didn't exactly roll up their sleeves and clench their fists when they priced the Model 30. Clearly, you can find a comparable system at a lower price elsewhere, without switching to 3½-inch disks. But this time, other than passing up the IBM reputation, you'll also be missing your chance to get in on the ground floor of the new system.

Gus Venditto is senior editor at PC Magazine.

PC MAGAZINE

FACT FILE

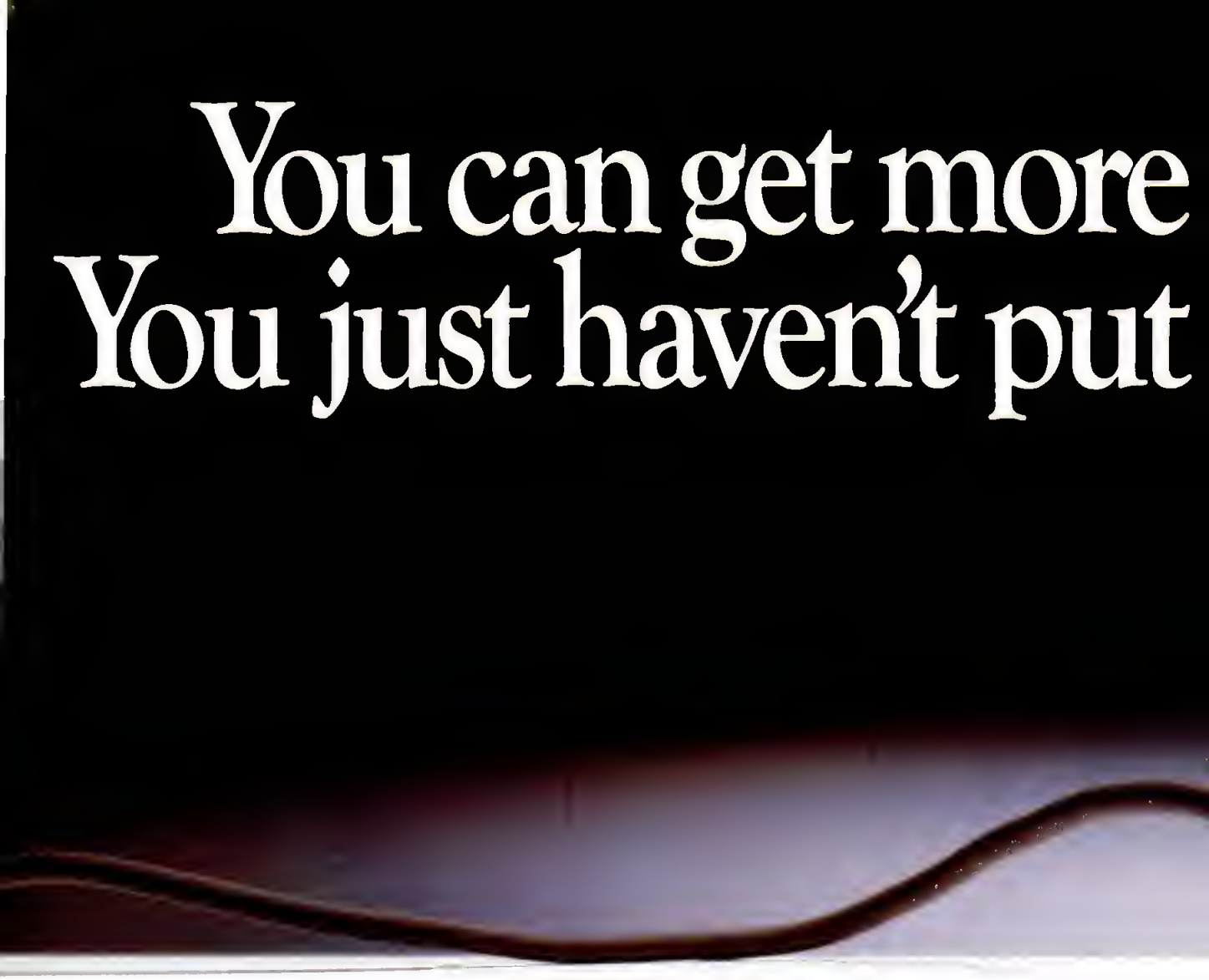
IBM Personal System/2 Model 30
IBM Corp.
Consult your local authorized IBM dealer: (800) 447-4700
List Price: Model 30-002, $1,695, includes two 3½-inch, 720K-byte disk drives; Model 30-021, $2,295, includes one 3½-inch, 720K-byte disk drive and a 20-Mbyte hard disk.
Requires: DOS 3.0 or later, VGA-compatible monitor.
In Short: Smart engineering and VLSI technology put most everything you need on the Model 30's system board: graphics, 640K RAM, and disk controllers. You can add three XT-compatible expansion boards, but the shaky design of the expansion bus connector won't instill confidence.

CIRCLE 057 ON READER SERVICE CARD

The Model 30's 101-key keyboard has a luxuriously long 6-foot cable. The design, featuring 12 function keys and LED displays, is identical to that of the enhanced AT keyboard. The two-button mouse (a $95 option) plugs directly into the system rather than into a port und comes with a device driver.

Photographs Thom O'Connor

You can get more
You just haven't put



Just put your finger on a Microsoft® Mouse and you'll be getting more done in no time.

Because the Microsoft Mouse comes with a fistful of software including presentation graphics programs like Show Partner™ and Microsoft Paintbrush® and Expert Mouse Menus for your favorite business programs.

To enter a command with a Microsoft Mouse, just find it on the on-screen menu and click. Not having to enter a handful of keystrokes means you can work much faster.

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This mouse knows its 1-2-3's.

The Expert Mouse Menu for use with Lotus® 1-2-3® gives you faster access to functions you use all the time like displaying graphs, setting titles and opening windows. Then print out your worksheet with one click of our mouse rather than seven keystrokes.

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out of your PC. your finger on it.

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Show Partner and Microsoft Paintbrush help you and your Microsoft Mouse create presentation graphics and special effects that will keep your audience focused on the point at hand.

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The Microsoft Mouse is supported by over 200 software applications and multitudes of users. In fact, the readers of *PC World* magazine have given the Microsoft Mouse the World Class Award for the past three years. No wonder it's the best selling mouse on the market.

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IBM PERSONAL SYSTEM/2 MODEL 50

The PS/2 Model 50 is tiny in comparison with the AT it supersedes, yet it is more powerful and priced in the same range. Standard equipment includes a 3½-inch microfloppy disk drive and an agonizingly slow (80-millisecond access time) 20-megabyte hard disk that cries out to be replaced by a larger, faster unit. The VGA monitor is optional, and four models ($250–$1,550) are available.

Photograph: Roberto Brown

With its small footprint, Micro Channel bus, and 10-MHz speed, the Model 50 could set the standard for the next generation of desktop workstations.

At first thought, the prognosis for the Personal System/2 Model 50 is grim: a new, smaller PC incompatible with the old hardware and made mostly from plastic. For a clone the future would seem bleak. Even IBM should have learned a lesson from such previous designs.

Lo! The Personal System/2 Model 50 proves itself a worthy successor to the PC line. Although its advantages might not be obvious today, eventually the Personal System/2 Model 50 will be the machine to own.

At 10 MHz, generally operating with one wait state, the Personal System/2 Model 50 uses the fastest 80286 technology that IBM offers, matching what undoubtedly is the new standard of the PC industry. It incorporates a novel design that makes adding or modifying the system hardware configuration a matter even the most ham-handed klutz can handle. It's small enough to fit into a desk drawer (if you have a large, empty desk drawer). At $3,595, it's amazingly affordable (in the IBM scheme of things). And it offers innovations that truly make the Personal System/2 Model 50 the next generation of personal computer.

The breaks with the past should be expected: the PC standard is more than 5 years old, edging past the lifetime predicted for its design when the machine was first introduced in 1981 (the standard IBM product cycle was then pegged at 5 years). Without giving up software compatibility—and access to the largest base of business computer software in the world, programs written to the MS-DOS standard—the Personal System/2 Model 50 pushes the personal computer into new levels of technology needed for miniaturization and multitasking. It also adds more built-in security and a design that's optimized for automatic assembly, helping IBM build a made-in-America product that's cost-competitive with low-cost Pacific Basin labor.

ENGINEERING INNOVATIONS More compact than any previous IBM-brand 286-based computer (5½ by 14 by 18½ inches, HWD) the Personal System/2 Model 50 earns its small size by shrinking just about everything from disk drives to integrated circuit chips. Along with that size reduction comes a rethinking and reengineering of the PC expansion bus into IBM's new Micro Channel Architecture—resulting in such a complete restructuring that ordinary AT and PC expansion boards won't work in the Personal System/2 Model 50.

Part of the explanation is readily visible: the Personal System/2 Model 50 uses smaller expansion connectors, ostensibly so that their more closely spaced pins (on .05-inch centers) better match the spacing of the leads of the surface-mount components that are rife throughout the Personal System/2 Model 50.

The slots themselves are smaller, too. The new limit on expansion board size is 11½ by 3 inches, with spacing of about ¾ inch between the slots.

The Personal System/2 Model 50 provides four slots, all with the new 16-bit Micro Channel bus, but one is used by the standard equipment hard disk controller. Two of the others (and the hard disk slot) use dual 58-pin connectors that look like miniaturized versions of the old AT bus. The fourth adds an extra section for exchanging video signals with the new graphics system that's built into the system board.

Expansion cards are secured at the bottom rather than the top by knurled captive screws. Unless Rambo starts installing blank retaining brackets on the IBM production line, you should be able to loosen the screw and swap cards using no tools, just your fingers.

THE NEW BUS More important than the physical innovations, however, are alterations IBM has made to the electrical structure of the expansion bus. Many of the characteristics of the Personal System/2 Model 50 Micro Channel expansion bus are familiar: 24 address lines capable of handling 16 megabytes, 16 data lines, and the ability to detect when 8- or 16-bit bus expansion cards are used. Beyond

that, IBM has incorporated additional measures of control, including a special bus arbitration manager.

The new bus arbitration hardware allows the Personal System/2 Model 50 to shift more efficiently between different tasks. In addition, the Personal System/2 Model 50 features eight Direct Memory Access (DMA) channels, all of which may be operated simultaneously to shift bytes between memory, disks, video, and I/O ports. Thus the very heart of Personal System/2 Model 50 proves that it was designed from the beginning to be a multitasking computer.

Other bus modifications, such as the use of level-sensitive instead of edge-sensitive interrupts, will be of concern only to hardware developers. However, IBM has also made life easier for end users to install system options by incorporating a new Programmable Option Select (POS) system into the Personal System/2 Model 50. The POS system detects the expansion options installed in the Personal System/2 Model 50 and automatically sets the machine up accordingly. No more DIP switches or jumpers to worry about.

The new Micro Channel bus continues the IBM personal computer tradition of open architecture. IBM technical reference materials furnish all the support necessary for hardware developers to create their own internal peripherals.

PHYSICAL CONSTRUCTION The physical construction of the Personal System/2 Model 50 shows that IBM can learn from its mistakes, and learn a lot. The construction of the Personal System/2 Model 50 continues the tradition started with the PC*jr* and carried on by the Proprinter: an easy-to-manufacture plastic case filled with snap-together subassemblies. The result in the Personal System/2 Model 50 is that the whole system can be field stripped into its major subassemblies in a minute or two, even if you've never taken a glance at a service and repair manual.

The case, although different in design and execution, is conceptually the same as that of the PC*jr*—high-impact plastic liberally painted with conductive silver paint for the radio frequency shielding required to make the Personal System/2 Model 50 meet FCC Class B emissions specifications. One large plastic casting serves as the foundation and back panel for the chassis. A second provides an inner drive shelf, and a third becomes the front panel itself.

Only the top and sides are genuine metal, a single-piece stamping with rolled bottom and rear edges, plus spot-welded brackets for the attachment of the front panel. Metal braid in lips around the edges of this cover ensures that no stray electrical emissions leak out.

The exterior of the front panel is divided into four functional areas. On the right, the red paddle of the on/off switch pokes through. Two small rectangular cutouts allow LEDs to gleam through to indicate power on (green) and hard disk activity (yellow).

Next on the right are two cover panels for the floppy disk drives. Unlike those on previous PCs, these covers are part of the chassis front panel—not the disk drive. They are individually removable for upgrading the system drive endowment.

The final section on the far left merely covers the speaker and provides a convenient resting place for the IBM logo. The bottom third of the front panel is slotted for system ventilation.

The rear panel looks Spartan compared with previous IBM designs. On the left are three shiny metal retaining brackets hiding internal expansion slots. At the right rear is a single power connector but no provision for juicing up a display. Along the bottom run the connectors for the built-in ports: serial, parallel, display output, and two input ports. At top left is a key lock that prevents people from poking inside the chassis when you're not around. Two knurled, finger-tight captive screws at the top of the rear panel hold the lid on the system.

INSIDE THE PS/2 The inside of the Personal System/2 Model 50 holds its real wonders. There's not a loose wire to be found. The whole computer consists of naught but plug-together subassemblies. Even the lowly screw has been nearly banished. Most of the machine merely snaps or slides together.

Dominating the right side of the system unit is the long, narrow chrome box of the switching power supply. As with that of the XT Model 286, this unit automatically figures out what kind of electricity you've plugged it into and adjusts itself accordingly, between 90 and 260 volts (in two discrete ranges, 90 to 137 and 180 to 265 VAC) at any frequency between 50 and 60 Hz.

The real efficiency of the Personal System/2 Model 50 design is best illustrated by the Personal System/2 Model 50 disk drives. The system has the capacity for three 3½-inch form-factor units: in the IBM scheme, two floppies and one hard disk. All of these drives mount on a molded plastic shelf which, again, is coated with conductive paint that shields the drives from the system electronics.

The two floppies (one is standard equipment) install side by side directly behind the front panel. The drives are secured in place by special plastic rails on the bottom. They slide backward into a card edge connector that's mounted on either branch of a T-shaped printed circuit board that plugs into the system board below the mounting shelf. A small tab under the front edge of each drive latches it in place. To slide a drive out, you must gently lift this tab. During installation, it snaps securely down on its own. The drives themselves are made by Alps Electronics.

The hard disk drive installs inside the chassis, behind the floppies. It is held in

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IBM Personal System/2 Model 50
IBM Corp.
Consult your local authorized IBM dealer:
(800) 447-4700
List Price: $3,595
Requires: DOS 3.63, VGA-compatible monitor
In Short: The Model 50 is the foundation of IBM's Personal System/2 line: a cost-effective, multitasking single-user workstation. With three available 16-bit Micro Channel expansion slots, built-in communications ports, 1 Mbyte of RAM, and VGA graphics, it's affordably priced.

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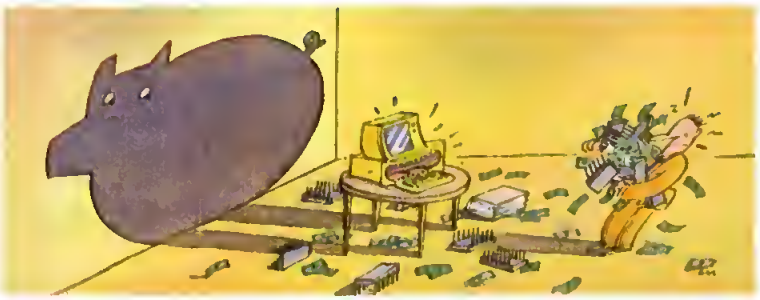

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place by a pair of rails, but it is also locked in place by a pair of plastic tabs, one at either side of the front of the drive. The hard disk plugs directly into its controller, which in turn plugs into one of the expansion connectors on the system board.

The standard Personal System/2 Model 50 hard disk itself is one of the system's major disappointments. A major step backward, the capacity of the IBM-made drive is a paltry 20 megabytes. Worse yet, with an average access time of 80 milliseconds, it performs like an XT drive. Only IBM would have the gall to put a slower drive in a faster computer. The Personal System/2 Model 50 really cries out for a better-performing, higher-capacity hard disk.

Higher-capacity drives (70 megabyte and beyond), which are available from IBM for step-up models of the new Personal Systems, use the enhanced small device interface (ESDI) interconnecting scheme and a 10-MHz data transfer rate. However, the 20-megabyte units of the Personal System/2 Model 50 are strictly standard ST-506, with a 5-MHz transfer rate. Presumably, the flexibility gained by putting the hard disk controller on an expansion card rather than on the system board promises that a higher-performance product may become available for the Personal System/2 Model 50.

The entire drive shelf is secured by eight snap-lock connectors that can be popped loose either with a finger grip or by using a special tool (actually a small piece of molded plastic) that is included inside the Personal System/2 Model 50. The whole shelf can be removed, with or without the drives remaining in place (if you don't mind sliding out the controllers and T-board adapter at the same time).

At the rear of the shelf, to the right of the center of the system unit, is a large diameter fan in a slide-in plastic mounting that's also secured by a snap-lock connector. Because of this fan and its placement, system airflow and cooling is superior to previous PC designs. Fresh air is sucked through the ventilation slots in front of the machine, over the electronics and disk drives, and exhausted directly out the rear of the machine. The hottest element of the system—the hard disk drive—is located nearest to the fan.

Quieter than the power supply fans of previous IBM desktop machines, the new fan—rated at 40 dB with system noise increasing to 46 dB when the disk drives are running—the fan noise should be objectionable only in quieter offices. (It still bothers me.)

The loudspeaker and battery pack comprise a third removable assembly, normally located in the left front corner of the chassis. The battery is separately removable from this chassis and is, thankfully, a relatively common Panasonic 6-volt unit.

A more formidable obstacle to the clone makers is surface-mount technology used for the system board and the hard disk controller of the PS/2 Model 50.

■ ■ ■ ■ ■

THE SYSTEM BOARD Underlying all is a near-masterpiece of a system board. Besides the nominal circuitry of previous AT system boards, it contains the serial and parallel ports, clock, and full megabyte of memory that AT-compatible makers have been installing on their motherboards for years. To this basic endowment, IBM adds a floppy disk controller and an entirely new video system.

Prominent on the board are three square aluminum cans and a similar black epoxy chip, each about 2 inches on a side. These components are very large scale integration (VLSI) circuits custommade by IBM. Some reporters believe that these proprietary chips are IBM's attempt to prevent (or make more difficult) the cloning of the Personal System/2 Model 50. But, noting the rapid appearance of Chips and Technologies' EGA and AT VLSI chip sets, undoubtedly the Personal System/2 Model 50 chips are under the electron microscope right now, and engineers are heading full speed in reverse.

A more formidable obstacle to the clone makers is the surface-mount technology used for the system board and the hard disk controller of the Personal System/2 Model 50.

Ordinarily, discrete parts are installed on conventional printed circuit boards by sliding component leads through holes in the circuit board, then soldering the components into place. Although large board makers automate their production lines, this assembly technique is just as available to garage and basement manufacturers. Anyone with a soldering iron can build this sort of circuit board.

Surface-mount technology changes all that. Surface mount puts chips and other circuit components into packages a fraction the size of those with ordinary leads. That makes circuit boards more compact and helps shrink the size of the Personal System/2 Model 50 motherboard.

However, as the name implies, surface-mount technology breaks with past tradition. Component leads solder to the surface of the circuit board rather than sliding through holes in it. Because of the small chip size and the unconventional installation technique, making surface-mount circuit boards requires specialized and expensive machinery, currently out of reach for the garage shop. Smaller and low-volume manufacturers will have a difficult time breaking into the Personal System/2 Model 50 market.

SYSTEM AND VIDEO MEMORY Despite the VLSI chips, the Personal System/2 Model 50 motherboard still uses a large amount of discrete logic. Eventually these chips may be squeezed into the VLSI arrays, too, condensing the system board (or that of a clone) even further.

On the right side of the system board are two separate memory banks for system RAM and the video display. Base configuration of the Personal System/2 Model 50 includes a full megabyte of dynamic RAM, implemented in two memory boards, each of which contains six IBM proprietary RAM modules near the

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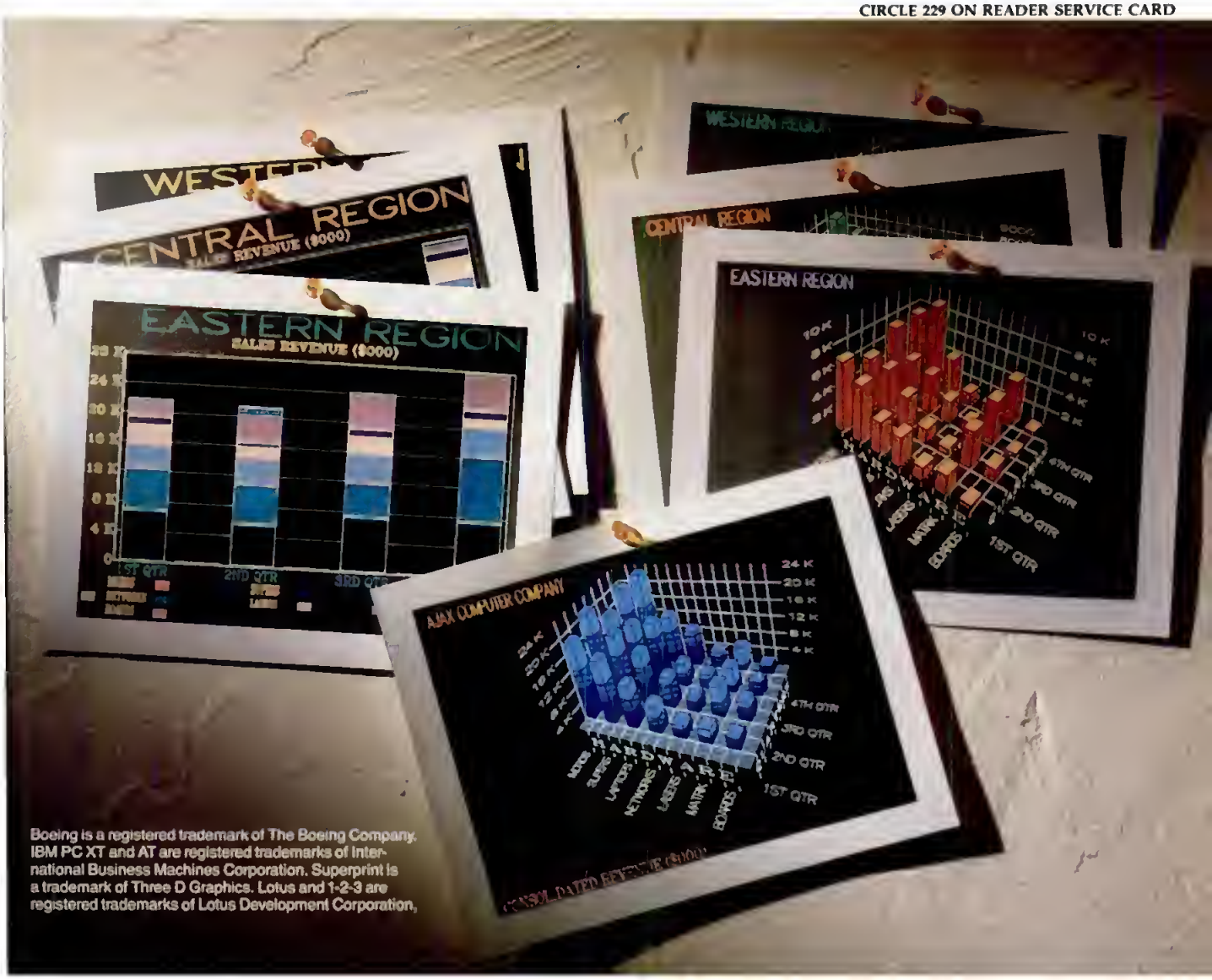

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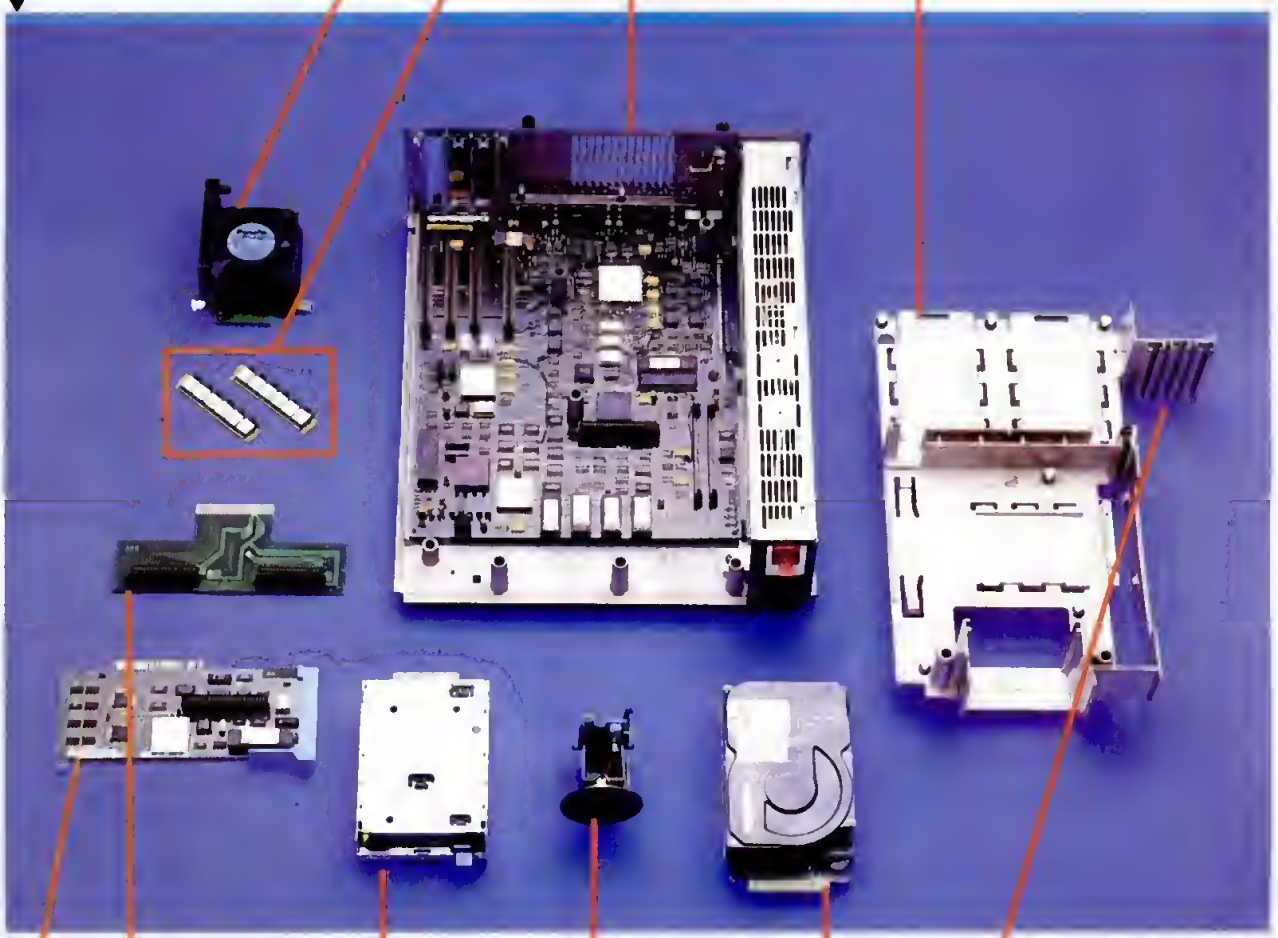
PS/2 Model 50

A marvel of modular design, the Model 50 should make for easier PC maintenance and repair. All of the main elements can be easily removed from the CPU chassis.



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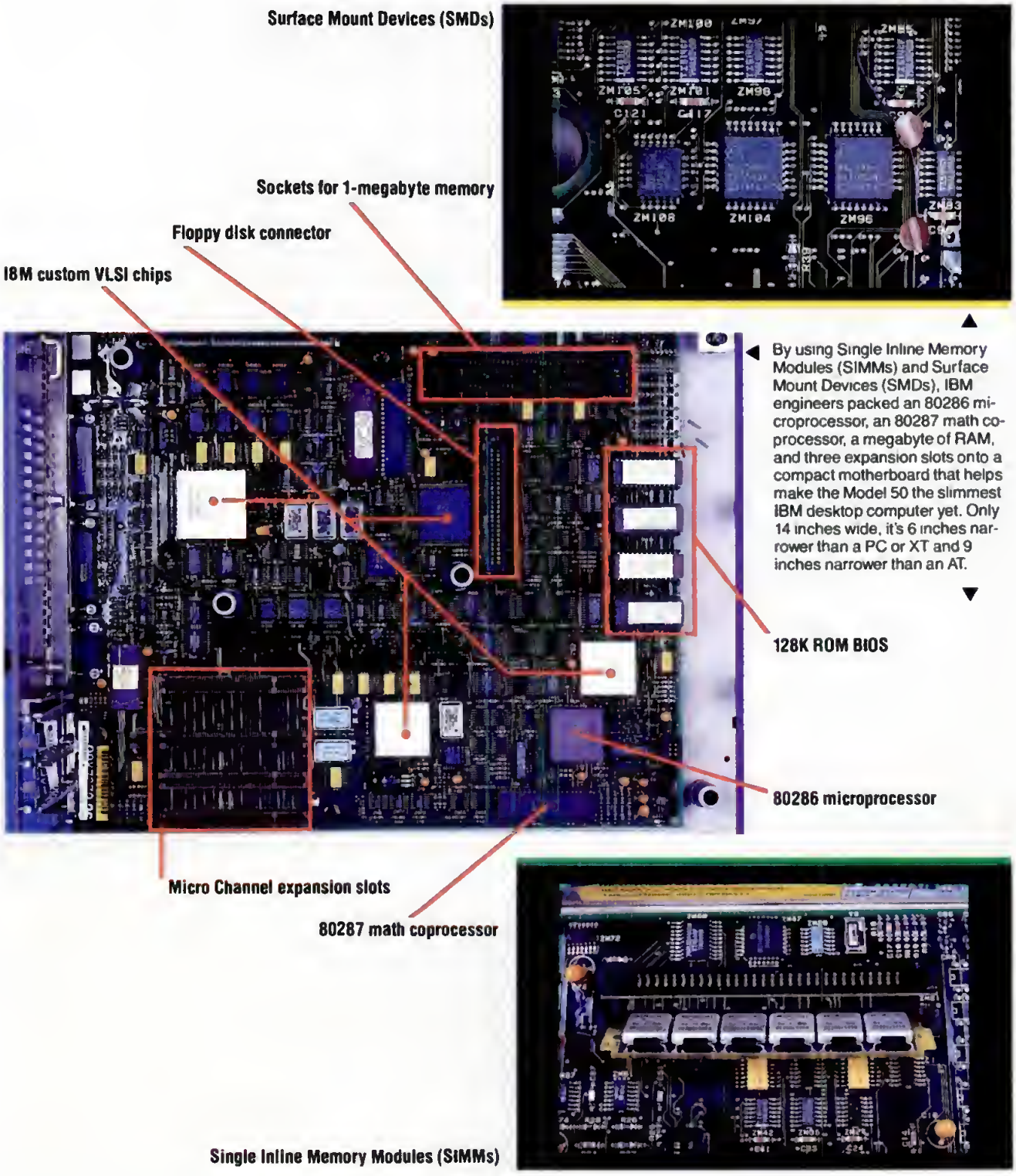

By using Single Inline Memory Modules (SIMMs) and Surface Mount Devices (SMDs), IBM engineers packed an 80286 microprocessor, an 80287 math coprocessor, a megabyte of RAM, and three expansion slots onto a compact motherboard that helps make the Model 50 the slimmest IBM desktop computer yet. Only 14 inches wide, it's 6 inches narrower than a PC or XT and 9 inches narrower than an AT.

front of the system board. The IBM memory map divides this endowment into 640K-byte base memory for DOS and 384K-byte extended. (Expansion board options can increase the official IBM RAM endowment to 7 megabytes, although the microprocessor can handle up to 16.)

Behind the system memory are eight 4-bit by 64K-bit chips used for video memory—a total of 256K bytes—soldered to the motherboard. Across the front edge of the system board runs a series of four socketed 32K-byte ROM chips, giving a total of 128K bytes of firmware (including, of course, BASIC). Another 64K bytes of battery-backed-up CMOS RAM, used for system setup information, is contained in the time-of-day clock chip, which is also located on the system board.

At the left front of the system board is the microprocessor, an Intel-made 80286-10, and nearly adjacent to it is a socket for an 80287-10 coprocessor. Both the main processor and coprocessor operate at 10 MHz, derived from a 40-MHz crystal soldered to the board. Because the microprocessor only devotes about 7 percent of its time to system overhead such as refreshing memory, it's actually a trifle faster than the 10-MHz speed in other one-wait-state machines.

The essentials of the system board floppy disk control system represent a continuation of past practices, based on a NEC 765 controller chip. However, system firmware has changed allegiances to support only 3½-inch floppy disk media at the old 700K bytes per disk, as well as the new 1.44 megabytes per disk formatted data densities. New, improved PC DOS 3.3 is also required to make use of the miniature high-density diskettes.

Although the parallel port built into the system board brings no new surprises, the serial port advances on its predecessors by supporting a speed one notch higher—19,200 bits per second—through use of a 16550 UART chip (a newer version of the 16450 used by the AT). Unlike the AT, however, the Personal System/2 Model 50 serial port uses a full-size male DB-25 connector. The parallel port uses the standard female DB-25.

The new Video Graphics Array (VGA) system is disappointing in that it incorporates no video coprocessor, such as Intel's 82786 or Texas Instruments TMS34010. Instead it is built around a proprietary gate array that offers improved resolution without the ten-to-hundredfold speed increase possible with a coprocessor. (A new, proprietary coprocessor board is available from IBM as an option.)

The highest color resolution supported by the system is 640 by 480 with 16 on-screen colors.

RESOLUTION The highest color resolution supported by the system is 640 by 480 with 16 on-screen colors (selectable from a palette of 256). A degraded, two-color (monochrome) mode is also available at the same resolution. That resolution capability is very desirable because it results in easy-to-calculate and -manipulate square pixels on normal 4:3 aspect ratio monitors. A new 320 by 200 graphics mode that allows 256 simultaneous on-screen colors is also available.

Text resolution is even sharper: 720 by 400 pixels in either 16 colors or shades of gray in monochrome. Characters in this mode are more detailed than ever before, with each constructed from a 9 by 16 matrix of on-screen dots. These same characters are also available in a new 360 by 400 16-color text mode for 40-column displays.

As with previous new IBM video standards, taking full advantage of VGA requires an entirely new kind of monitor that uses an analog interface (rather than the digital displays used with all previous PC displays except the PGC).

Most of the new video modes require a horizontal frequency of 31.5 KHz with a refresh rate of 70 Hz to reduce flicker. Also available are two 60-Hz graphics modes that trade off a slower refresh rate for a greater number of text lines in graphics mode: 30 lines per screen, instead of 25 lines.

IBM offers four new displays to match the new VGA standard: three color (12, 14 and 16 inches, measured diagonally) and one paper-white monochrome. Color or monochrome displays can be plugged in interchangeably and still operate properly. The monochrome monitor displays up to 64 shades of gray, mapped from color by using only the green signal from the RGB triad.

The new display standard also incorporates a new connector with 15 pins instead of the previous 9, so you have no worries about accidentally plugging in the wrong display and turning it into charcoal.

For full software compatibility, the new VGA system also supports past IBM video modes down to 40-column text and graphics. In the old-fashioned 200-line video modes (320 by 200 and 640 by 200 graphics), the displays are double-scanned at a 400-line rate, making on-screen characters look sharper but just as chunky as on a 200-line display.

KEYBOARD AND MOUSE Although the keyboard used by the Personal System/2 Model 50 is the same as that of the latest AT models with the 101-key Advanced Keyboard layout, IBM has been at work updating the input provisions of the computer, too. The system unit now features built-in support for a pointing device (read: mouse).

The two input jacks on the rear panel of the Personal System/2 Model 50, which both use 6-pin DIN connectors, are supposedly identical so that the keyboard and pointing device can be plugged in interchangeably. However, the evaluation system wasn't as forgiving as IBM promised and gave an error message when the keyboard was connected to what it thought was the wrong socket.

Password protection is now built right into the keyboard system. The keyboard itself can be locked out so that unauthorized people cannot tamper with the system. The password is set with the new Personal Option Select setup utility.

IBM now supplies its own two-button mouse, rather elongated (though usable) in shape, that plugs into the Personal System/2 Model 50 with a single cable and requires no separate power supply. The IBM mouse is built around a free-spinning rubber trackball, much like the Microsoft product.

Even the setup and diagnostic software supplied with the Personal System/2 Model 50 has stepped a generation forward. Instead of the stark white text of previous products, the new system uses colorful menus that give a stacked windows-like effect as you dive through their depth. Option selection is now automatic, facilitated by the POS system.

THE DOWNSIDE Buying the Personal System/2 Model 50 today has its downside: 3½-inch disks only, and no internal expansion options except for those supplied by IBM. Only when IBM's multitasking Operating System/2 finally becomes available (promised early next year) and software makers release new products for it will the Personal System/2 Model 50 really prove its worth. If you need hefty PC power now and price is important, a cheap AT clone is still a good bet.

As time goes by, however, the current shortcomings of the Personal System/2 Model 50 will disappear (though the machine will still be burdened by a slow hard disk). Its upside is its future. The Micro Channel bus and downsized everything hold the potential for being the standard for the next generation of desktop workstations. Buying a clone today may load down your desk with obsolete hardware the day you decide you need a multitasking system.

Compared with the brand name 10-MHz AT compatibles that are currently available, the added expense in acquiring the $3,595 Personal System/2 Model 50 is trifling once you figure in all the built-in features (like VGA) and its future promise. It's an attractive machine at an attractive price that promises to become increasingly valuable to you, notwithstanding physical depreciation, as progress is made in software.

Winn L. Rosch is a contributing editor of PC Magazine.

Triple Standard

■

THREE NEW VIDEO MODES from IBM

IBM's new Personal System/2 line of products includes three new video standards and four new monitors. All of the PS/2 models have a video adapter built into the system board. All you need to get running is one of the new monitors.

The three new video standards are the Multicolor Graphics Array (MCGA), which is built into the Model 30 system board; the Video Graphics Array (VGA), which is built into the Models 50, 60, and 80 system board (the VGA is also available as an add-on board for the Model 30 or existing PCs, XTs, and ATs); and the 8514/A, a high-resolution add-on board for the Models 50, 60, and 80.

All of the new video adapters include 640 (horizontal) by 480 (vertical) graphics resolution, which ia a step up from the 640 by 200 graphics of the IBM Color/Graphics Adapter (CGA) and the 640 by 350 graphics of the Enhanced Graphics Adapter (EGA).

IBM has also gone analog—all of the new video adapters are capable of displaying 256 simultaneous colors out of a palette of 262,144 total colors. There's a catch, however. Although IBM was able to dazzle spectators with some stunning 256-color displays during its PS/2 announcements, the morning-after analysis revealed a disappointment: with the exception of the expensive 8514/A, the 256 simultaneous colors can only be displayed in 320 by 200 graphics resolution.

The new video adapters have compatibility modes that emulate the CGA and EGA, so most existing software should

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With three new standards and four new monitors, IBM hopes to change your definition of high-quality video output.

run with only the usual number of problems inherent in video emulation. Expect software support for the new video modes real fast: IBM has wised up and now recognizes the importance of communicating with software vendors.

THE 640 BY 480 ADVANTAGE The 640 by 480 resolution is not new, even to IBM. IBM's $2,995 Professional Graphics Controller used 640 by 480. But this is the first time IBM is giving this resolution to the masses. In doing so, they're a little behind other manufacturers. Many of the "super EGA" boards—such as those from Paradise, STB, Tseng Labs, and Video-7—have already been offering 640 by 480 for owners of the NEC MultiSync and other variable-sync monitors.

What's so magic about 640 by 480? The viewing area of most video displays has an aspect ratio of 4:3, which means that the display is one-third wider than it is high. With a resolution of 640 by 480, the number of pixels per inch is the same both horizontally and vertically.

While this little dividend is nice for programmers, it also benefits users. In some cases, it means faster graphics with less distortion. A graphics program can use the same digitized fonts for both horizontally and vertically aligned text, reducing storage necessary for the fonts.

IBM has also made the switch from digital to analog. This allows a greatly increased array of colors.

In a digital video system, each color signal that the adapter sends to the monitor can be either on or off. The CGA had four color signals and can display 16 different colors. The EGA has six color signals and can display 64 different colors.

An analog system requires only three color signals: red, green, and blue. However, each of these signals can be varied over a continuous range. All the new IBM video adapters can generate 64 different levels for each of the three color signals. The total number of red-green-blue combinations is 64 times 64 times 64, or 262,144. This is called the "palette."

In most analog video systems, the number of colors that can be *simultaneously* displayed is much lower. This is a restriction based on the amount of video memory and its organization within the adapter hardware. At best, the new IBM video adapters can display only 256 of these colors at once.

Photograph: Courtesy of IBM

The effective resolution of the VGA adapter's 80-column text mode is 720 by 400.

The Multicolor Graphics Array (MCGA) is the low-end member of IBM's new line of video adapters. It is found only on the PS/2 Model 30. The MCGA has 64K bytes of video memory and offers emulation of the IBM CGA (320 by 200 graphics mode with four colors, 640 by 200 graphics mode with two colors), a new 320 by 200 graphics mode with 256 colors, a new 640 by 480 graphics mode with two colors, and use of an 8 by 16 character box in text modes.

In 80-column text mode, the effective resolution is 640 by 400, but this resolution is not available in graphics. In all video modes, the colors can be chosen from the palette of 262,144 colors. (As you might expect from past experience, IBM does not give you a utility to do this.)

The PS/2 Models 50, 60, and 80 have an on-board video adapter called the Video Graphics Array (VGA). This adapter has 256K bytes of memory (the same amount as a fully loaded EGA) and offers emulation of the IBM EGA (including CGA emulation), 320 by 200 graphics mode with 4 or 16 colors, 640 by 200 graphics mode with 2 or 16 colors, 640 by 350 graphics mode with 16 colors, a new 320 by 200 graphics mode with 256 colors, a new 640 by 480 graphics mode with 2 colors, a new 640 by 480 graphics mode with 16 colors, and use of a 9 by 16 character box in text modes.

The effective resolution of the 80-column text mode is 720 by 400, but this is not duplicated in the graphics modes. As in the MCGA, the colors can be chosen from the 262,144-color palette.

SORTING OUT THE MODES The new (and old) video modes seem to encompass a lot of different dimensions, but they separate into a few groups.

All of the graphics modes have a horizontal resolution of either 640 or 320. The VGA text mode is an oddity at 720. All the modes use one of three possible vertical resolutions: 350, 400, or 480. What happened to the vertical resolution of 200? For these modes, the adapter simply displays each scan line twice for 400 scan lines. The 400 scan lines are also used in the text modes: each character is 16 pixels high, and 25 lines of text are displayed.

The VGA gets by with only two crystals: a 25.175-MHz for the 640 and 320 horizontal resolutions and a 28.322-MHz for the 720 pixels used for text. All video modes have a horizontal sync rate of 31.5 KHz. The 350- and 400-scan-line modes have a vertical sync rate of 70 Hz; the 480-scan-line modes run at 60 Hz.

The VGA BIOS contains three fonts that can be loaded into the adapter or used to display text in graphics modes. An 8 by 8 font is used with the 200-scan-line graphics modes when writing text, an 8 by 14 is used for the 350-scan-line graphics modes, and an 8 by 16 font is used in the text modes and the 480-scan-line graphics modes.

On the EGA it is possible to use the 8 by 8 font in text mode to get 43 lines on the display instead of 25. With the VGA you can also use the 8 by 8 font in text mode, but then you will get 50 lines per screen.

An owner of a Model 30 (or an existing PC, PC-XT, or PC AT) can add VGA by the purchase of the PS/2 Display Adapter

for $595. (We have not seen this board yet; IBM expects to release it this month.) Since VGA is also EGA compatible, this is a very nice price and comparable with existing "super EGA" boards.

With both the MCGA and VGA, the only way you can get 256 simultaneous colors is with the 320 by 200 graphics mode. It sure looks pretty, but if you want to display text along with the graphics, you're limited to 25 lines of 40 characters. This is not adequate for many applications.

What makes this problem all the more frustrating is that the 256K bytes of video memory in the VGA is sufficient for a graphics video mode of 640 by 400 with 256 colors. Whether such a mode is possible with custom programming of the VGA registers is not clear yet, but it's definitely not supported by the BIOS.

With the arrival of OS/2, most graphics applications will probably be programmed for the OS/2 Windows Presentation Manager. *Windows* requires an 80-character-wide display, which means that *Windows* will need to use the 640 by 480 mode with 16 colors.

The only way you can get more than 16 colors in a 640 by 480 mode is to make the step up to the 8514/A adapter (described here later).

PROGRAMMER'S PERSPECTIVE From the programmer's perspective, the VGA is very similar to the EGA: it uses the same registers, similar color plane mappings for the 640 by 480 modes, and has an enhanced BIOS interface that builds upon the EGA BIOS.

IBM has fixed some of the hardware and BIOS bugs in the EGA and made most registers read/write. This means that it's possible to retrieve and later restore the entire video state. This is very useful for a multitasking environment when dealing with programs that directly access the video hardware.

The video adapter hardware and register documentation is included in IBM's *Technical Reference* manuals for the PS/2 models. IBM also has a new "BIOS Interface Technical Reference" that documents the BIOS for all PC and PS/2 machines. This manual includes lots of programming hints: for instance, how to deal with the ever-more-perplexing problem of determining what type of adapter is attached to the machine.

However, the "BIOS Interface" manual does not include actual BIOS listings. Programmers will have a rougher time determing what's really going on inside the BIOS in order to resolve questions about BIOS quirks and BIOS bugs and to learn about techniques for using the PC and PS/2 hardware directly. The manual also does not include other vital information, such as the video parameter tables.

All the new video adapters have a new 15-pin connector for the monitor cable. The boards cannot be used with previous IBM monitors and most compatible monitors. IBM has four new analog monitors (see table) for the PS/2 machines. You can connect any of these four monitors to either the MCGA or VGA adapters.

The low-cost 8503 is not a high-persistence green-screen monochrome display of the type we're accustomed to, but a true black-and-white monitor capable of displaying 64 gray shades.

Even with four monitors, this selection isn't satisfactory. The 8512 uses black-stripe technology, and it's a bit too fuzzy; the 8513 is too small compared with previous IBM monitors; the 8503 is priced right, but it's also small and doesn't display color; the 8514 is just about right—except that it's too expensive.

Can NEC deliver a conversion cable to connect a MultiSync to the new adapters? The unofficial word is yes, but we haven't seen one yet. If NEC comes through with one, *PC Magazine* readers will be among the first to know about it.

IBM's New Line of Monitors

Model	Price	Screen size (inches)	Description
8503	$250	12	Black and white
8512	$595	14	Color
8513	$595	12	Color
8514	$1,550	16	Color

THE 8514/A ALTERNATIVE The 8514/A Display Adapter board is IBM's high-end add-on for the PS/2 series. Neither the 8514/A nor technical documentation is available yet; at the time of this writing, IBM anticipated a June 1987 release.

The 8514/A uses the new bus connector, so it can be installed only in the PS/2 Models 50, 60, and 80. The board occupies a special slot in these machines that allows integration with the on-board VGA. The 8514/A board costs $1,290 and has a 1,024 by 768 16-color graphics mode in addition to the VGA modes. The resolution of 1,024 by 768 also preserves the 4:3 aspect ratio.

Adding the $270 8514 Memory Expansion Kit gives you two new video modes: 640 by 480 graphics mode with 256 colors, and 1,024 by 768 graphics mode with 256 colors. As with the VGA, the colors can be chosen from a palette of 262,144. IBM has indicated that the 8514/A includes a hardware assist for lines, fills, and bitblt (bit block transfers), but it stops short of saying it has a graphics coprocessor.

Although you can use any of the four PS/2 monitors with the 8514/A, only the 8514 monitor allows the 1,024 by 768 resolution.

The total cost of the 8514/A, the 8514 Memory Expansion Kit, and the 8514 monitor is $3,110. This is actually not a bad price for a high-resolution color system. Keep in mind that IBM's fully loaded EGA and Enhanced Graphics Monitor combination costs $1,662 and has a resolution of only 640 by 350 with 16 colors.

Does IBM realize that the 8514/A might appeal to a wider audience than just CAD/CAM professionals? Probably not. Although IBM has endorsed *Windows* for OS/2, it still doesn't seem to have grasped the fact that high-resolution big-screen graphics workstations are suitable for *everybody*.

IBM is going to be surprised at the sales of the 8514 system—it should have given this system a proper name.

Charles Petzold is a contributing editor of PC Magazine.

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A credit firm that supplies information to banks employs Bernoulli Boxes to work with smaller banks and credit unions. Credit requests are controlled on individual cartridges, making it easy to keep track of information and disperse it to the appropriate users. This unique approach to database management uses cartridges as electronic file cabinets, combining the best of physical and electronic data management.

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PROGRAMMING:

One of the largest software developers in the U.S. uses Bernoulli Boxes to manage enormous amounts of software source code. Programmers record all the source code for an application on one cartridge, make backup cartridges for protection, and work directly from a "working" cartridge. This allows them to modify code or develop revisions on multiple cartridges, without fear of damaging the original source code, which is safely stored on the "backup" cartridge.

GRAPHICS:

An architect in Chicago uses over 40 Bernoulli Cartridges a year archiving lengthy architectural designs generated on a CAD system. Using a Bernoulli Box gives him unlimited storage capacity, plus the portability to take cartridges with him when he meets with clients and contractors (many of whom also use a Bernoulli Box). This fast growth is a powerful benefit of Bernoulli Technology,™ whether for CAD, graphics or desktop publishing.

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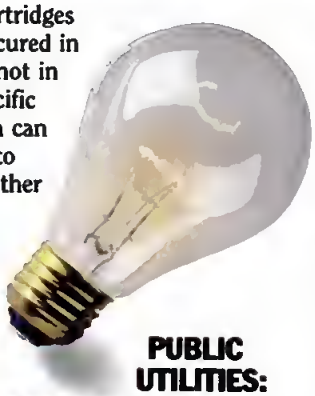

PUBLIC UTILITIES:

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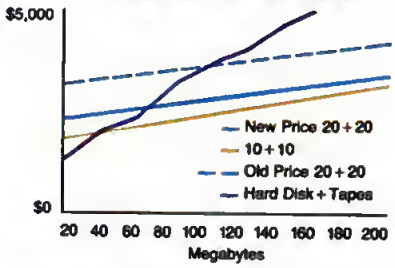

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IBM PERSONAL SYSTEM/2 MODEL 60

The PS/2 Model 60 is IBM's first personal computer designed to be positioned on the floor and used as the base of a multiuser system. $5,295 buys you a 3½-inch microfloppy drive, a speedy 44-megabyte hard disk, eight 16-bit expansion slots, and full-height drive bays that increase the number of available hard disk options. As is the case with the other PS/2 models, the VGA monitor pictured here is an option.

Photograph: Roberto Brenson

The PS/2 Model 60 has the kind of speed and multitasking power that could be the foundation of a small multiuser system.

A multiuser computer system must be able to stand on its own two feet. At least that's one interpretation of the philosophy behind the Personal System/2 Model 60, the machine IBM has designed as a medium-power multitasking, multiuser departmental and small business command center. The tower construction of the Model 60, which stands on two fin-like feet, has ample room for whatever expansion a multiuser machine might need.

Its power—based on a 10-MHz, one-wait-state 80286 microprocessor—makes it the logical replacement for today's AT in tomorrow's shared resource systems.

IBM offers the Personal System/2 Model 60 in two configurations, differing only in the hard disk included. The $5,295 Model 60-041 features a conventional 44-megabyte hard disk; the $6,295 Model 60-071 (not yet available) ups that capacity to 70 megabytes and doubles the disk data transfer rate with a more advanced disk interface. Both include as standard equipment a 1.44-megabyte, 3½-inch floppy disk drive; built-in serial, parallel, and mouse ports; high-resolution graphics; 1 megabyte of RAM; and a keyboard.

The most striking aspect of the PS/2 Model 60—and the design feature that testifies most directly to its multiuser design—is its packaging. While previous PCs have been adaptable to standing on the floor rather than sitting on your desktop (IBM offers edge-mounting cocoons for both the AT and RT), the Model 60 is the first true PC designed solely for vertical installation beside a desk. Standing 23½ inches high, 19 inches deep, and 6½ inches wide with its flat feet extending to a width of 12½ inches, the Model 60 is foremost a deskside (rather than desktop) companion.

All the controls you might normally have to access—the power switch, power and drive activity indicator LEDs, drive slots, and disk-release push buttons—are conveniently arrayed at the top of the tower on its front side. Unlike the edge-mount AT, access to the innards no longer requires coaxing the computer from the security of its protective outer shell, then resting the system unit flat on a desktop. Instead, the left side of the chassis can be pried off with no need to upset the Model 60 or move it from its normal operating position.

The chassis lid is secured for two captive screws with slotted heads large enough to make a penny, nickel, or dime the only tool needed for loosening the cover. A key lock ensures against unauthorized access but affords only physical security. Unlike the AT, the Model 60 lock does not switch off the keyboard. But an electromechanical keyboard lock is unnecessary because the keyboard can be electrically deactivated using a built-in password system.

The Model 60 case is molded from pale gray/beige high-impact plastic and coated with silver-based metallic paint to keep radio frequency interference from its electronics within the limits of FCC Class B certification. The system shell consists of three principal pieces: the main chassis, which forms the right side, top, bottom, and back; the removable left-side access cover; and a decorative, snap-on front panel.

The two feet, somewhat reminiscent of squared-off seal flippers, are bolted to the main chassis, as are all the internal subassemblies. For more compact storage or toting without fear of slicing open your ankles, you can rotate the Model 60's flippers out of the way. When standing, the machine is perfectly stable.

Should you decide to carry the Model 60 with you—for security, to move the machines between assignments in your business, or just to build up your biceps—you'll find IBM has thoughtfully included a full-length handle at the top of the case that folds down flat into a molded recess in the chassis. Though the handle does make the Model 60 more mobile than an AT, for example, at 40 pounds for the chassis alone, it can hardly be classed as portable. A set of wheels and a pull-chain would make more sense for interoffice maneuvers.

POWER PADDLE Beneath the handle, the top few inches inside the Model 60 case are filled by a squat, gamma-shaped power supply in a chrome-plated metal box that extends for the entire front-to-back depth of the system unit. The international orange power-switch paddle extends from the front edge of this subassembly.

As is IBM's practice on all its new personal computers since the XT Model 286, the Model 60 power supply is self-adjusting to whatever voltage is available. This autoranging capability adapts to line currents between 90 to 137 and 180 to 265 volts at line frequencies of either 50 or 60 Hz.

Inside the bottom of the power supply resides a large-diameter cooling muffin fan that sucks air out of the system unit. Compared with previous IBM wind generators, this one is quiet, almost inaudible compared with the constant buzz and grind generated by the spindle motor of the Model 60's hard disk.

The upper arm of the gamma rises over a stack of drive-mounting shelves at the front of the Model 60 case. Two over-and-under bays are allowed for 3½-inch form-factor devices, one of which is occupied by the standard-equipment 1.44-megabyte floppy disk drive. As with the floppy drives of other Personal System/2 models, those of the Model 60 merely slide into place on mounting rails on their bottoms. Each latches securely into place and has a plastic tab to release it underneath. All power, control, and data signals link up through a single-card edge connector at the back of the drive bay.

The decorative floppy disk drive bezel is part of the removable Model 60 front panel rather than part of the drive unit itself. Due to some unexplainable lapse in IBM's normal idiot proofing, you can snap this bezel in upside down should you be inattentive when installing a second drive. Unless you become violent when the slots don't line up, however, the worst possible damage from such a mistake will be little more than temporary frustration.

Beneath the power supply and the floppy disk drive bay is a large chamber that holds both the Model 60 system board, which hugs close to the right side of the case, and two full-height drive bays for 5¼-inch devices. At the bottom corner of the front of the Model 60 case, the combined speaker/battery-holder assembly stands out in a large empty area. This assembly is identical to the one used by the Model 50, equipped with a large, 3-inch loudspeaker and 6-volt Panasonic lithium battery.

FACT FILE

IBM Personal System/2 Model 60
IBM Corp.
Consult your local IBM authorized dealer:
(800) 447-4700
List Price: $5,295
Requires: DOS 3.3, VGA-compatible monitor.
In Short: IBM's 80286-performance-level multiuser, multitasking Personal System/2 Model 60 has eight 16-bit Micro Channel expansion slots, built-in communications ports, and VGA graphics. It's the logical replacement for today's AT in tomorrow's shared resource systems.

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BIG BAY The internal drive bays of the Model 60 may be the best excuse for the larger size of its chassis (when compared with the equivalent-performance Model 50). While the downsized Model 50 is severely limited in the hard disk options available (exactly one when the machine was introduced—an IBM unit that creeps along with a painfully slow average access time of about 80 milliseconds), the Model 60 faces no such constraints.

A steel subchassis screwed beneath its power supply endows the Model 60 with enough space to stock up to four standard half-height drives back to back in two full-height bays, mounted in a manner that matches the style used by the RT. Drives are installed in the steel subchassis by sliding them into place on mounting rails similar in concept but quite different in execution from those used on the AT. Once the drives are in their proper places, they are fastened down by tightening two blue plastic knobs atop each drive bay. The knobs apply screw pressure that lowers a clamp against each mounting rail.

Although the two drives that IBM offers for the Model 60 are both full-height devices, the Model 60 hints that half-height options may be part of its design: a strip of four spade terminals is provided for grounding add-in drives. However, the IBM power supply contains only two power connectors for plugging in additional drives (though a simple wye cable will eliminate any connector shortfall).

One of the internal drive bays is given front-panel access courtesy of a removable plastic blank in the front panel. Besides hard disks, this bay can give safe harbor to a tape backup system or a WORM (write-once, read-mostly) optical disk drive—or even a 5¼-inch floppy disk drive should some enterprising peripheral vendor package the necessities for such a system.

The standard hard disk in the bottom-of-the-line Model 60-041 is a made-in-America 44-megabyte unit that bears the IBM label. Like all the better drives now on the market, it features a voice-coil head actuator and automatically parks and locks its read/write heads when powered down.

Using the industry standard ST-506 interface, the 44-megabyte drive plugs into a proprietary IBM hard disk controller that's currently used only in the Model 60. It handles up to two drives, while the smaller card in the Model 50 can tackle only one. Despite their different physical size and drive-handling abilities, however, these two IBM controllers rely on similar circuitry, mostly hidden inside a square aluminum IBM-proprietary VLSI chip.

The performance of the 44-megabyte drive is commendably brisk (particularly compared with the miniature pig grunting away in the Model 50), turning in an average access time of under 33 milliseconds. To further improve performance, IBM formats the hard disks of the Models 50 and 60 with an interleave factor of 1-to-1 (compared with 3-to-1 for the AT and 6-to-1 for the XT) and adds a limited amount of disk caching.

The 70-megabyte hard disk of the Model 60-071, promised for delivery later this year, should improve further on that level of performance through use of an enhanced small device interface

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(ESDI) connection. The ESDI doubles the data transfer rates used in previous IBM personal computers, raising the speed at which a block of data can be moved from 5 to 10 megabits per second. Installing two of these drives will give an IBM-sanctioned Model 60 a system capacity of 140 megabytes.

IN THE CHIPS Underlying the hard disk subchassis and filling the balance of the case of Model 60 is its system board, now sometimes called a *planar* board by IBM and a *motherboard* by stodgy traditionalists.

As with the other models of the Personal System/2, the Model 60 motherboard breaks with IBM's previous design conventions in many ways. Making extensive use of compact surface-mount technology and proprietary VLSI chips, it incorporates all the necessary functions of a complete minicomputer (except for hard disk controller) on a single planar printed-circuit board. Among the standard features in its circuitry are serial and parallel ports, a high-resolution graphics-capable display adapter, a full megabyte of RAM, pointing device (mouse) input port, clock, floppy disk adapter, and a full endowment of expansion slots.

The central processor, an 80286-10, is actually relegated to the bottom right-hand corner of the motherboard. Accompanying it is a socket for an 80287-10 numeric coprocessor. Both of these chips are operated at their full rating of 10 MHz, with one wait state inserted when memory or the I/O system is accessed. Direct Memory Access (DMA) transfers, however, are handled at 10 MHz without the waits.

IBM credits this combination of processor and clock with having twice the speed of the AT. On *PC Magazine*'s benchmark tests, however, its performance turned out to be more in line with what would be expected of such a 10-MHz system: 20 to 30 percent faster than an 8-MHz AT. Disappointingly, the speed-determining 40-MHz crystal is soldered to the system board, precluding all but the most venturesome tinkerers from experimenting with supercharging the system.

The Model 60's standard megabyte of memory is packed off to a distant corner of the system board in the guise of four removable 256K-byte memory modules, each equipped with three IBM proprietary megabit-technology (but not megabit-capacity) memory chips.

The Model 60 hardware allocates 640K of the available bytes to DOS memory and the remaining 384K to extended memory. As with previous IBM personal computers, additional memory can be added on with expansion boards, up to the 16-megabyte addressing limit of the 80286 microprocessor.

The Model 60 hardware allocates 640K of the available bytes to DOS memory and the remaining 384K to extended memory.

Three other memory systems also decorate the system board. Four 32K-byte ROM chips, totaling 128K, fill a row of sockets on the front edge of the board. Eight 4-bit by 64K-bit chips near the center of the board are used for display memory. And 2K bytes of battery-backed-up CMOS RAM permit the nearly nonvolatile storage of system configuration information (in addition to the 64 bytes contained in the clock chip).

Only this last 2K-byte block of memory differs from the standard endowment of the Model 50. According to IBM documentation, one of its principle intended uses is to implement a hardware-based security system—for instance, storing one or more passwords to restrict system access.

Another innovation in the Model 60 and the rest of the Personal System/2 line is its Programmable Option Select (POS) system that eliminates DIP switches and most of the need for the unnerving AT setup utility. The Model 60 is able to detect the options that are installed inside it and configure itself accordingly, storing the setup information in its nearly nonvolatile CMOS memory.

The Model 60 floppy disk control electronics are based on the same chip—the NEC 765—as are all previous PC models. Despite this similarity, the Model 60 is configured to operate only 3½-inch floppy disk drives with formatted capacities of either 720K bytes or 1.44 megabytes using PC-DOS 3.3. Data transfers are made at 250 kilobits per second for the former, 500 kilobits per second for the latter.

A short ribbon cable connects the two floppy disk bays (and hence the disks when installed) to the system board through a small adapter board that might have been designed by Rube Goldberg before he hit his stride.

The Model 60 system board serial port is based on a 16550 UART chip that can operate at up to 19,200 bits per second. In comparison, the serial ports of PCs and ATs are limited to 9,600 bps. (These speeds are the maximum supported by IBM. Standard PC serial ports can achieve higher data rates through sophisticated programming.) Unlike the AT, the Model 60 uses an XT-style 25-pin male miniature D-shell connector for this serial port.

The system board parallel port, which is functionally identical to previous PC printer ports, uses the IBM-standard 25-pin female D-shell connector. This connector, along with the serial jack, two input devices, and one 15-pin video connector, is located in a strip along the rear of the Model 60 chassis, just above the option-retaining brackets of the system expansion slots.

SUPERSEDING BUS Inside these brackets the Model 60 provides eight 16-bit bus Micro Channel slots for internal expansion.

The Micro Channel bus arrangement supersedes and is incompatible with the 8- and 16-bit PC buses used by previous IBM personal computers. PC, XT, and AT expansion cards cannot be used in the Model 60 (or the Personal System/2 Models 50 and 80) because they will not physically fit into the system and are

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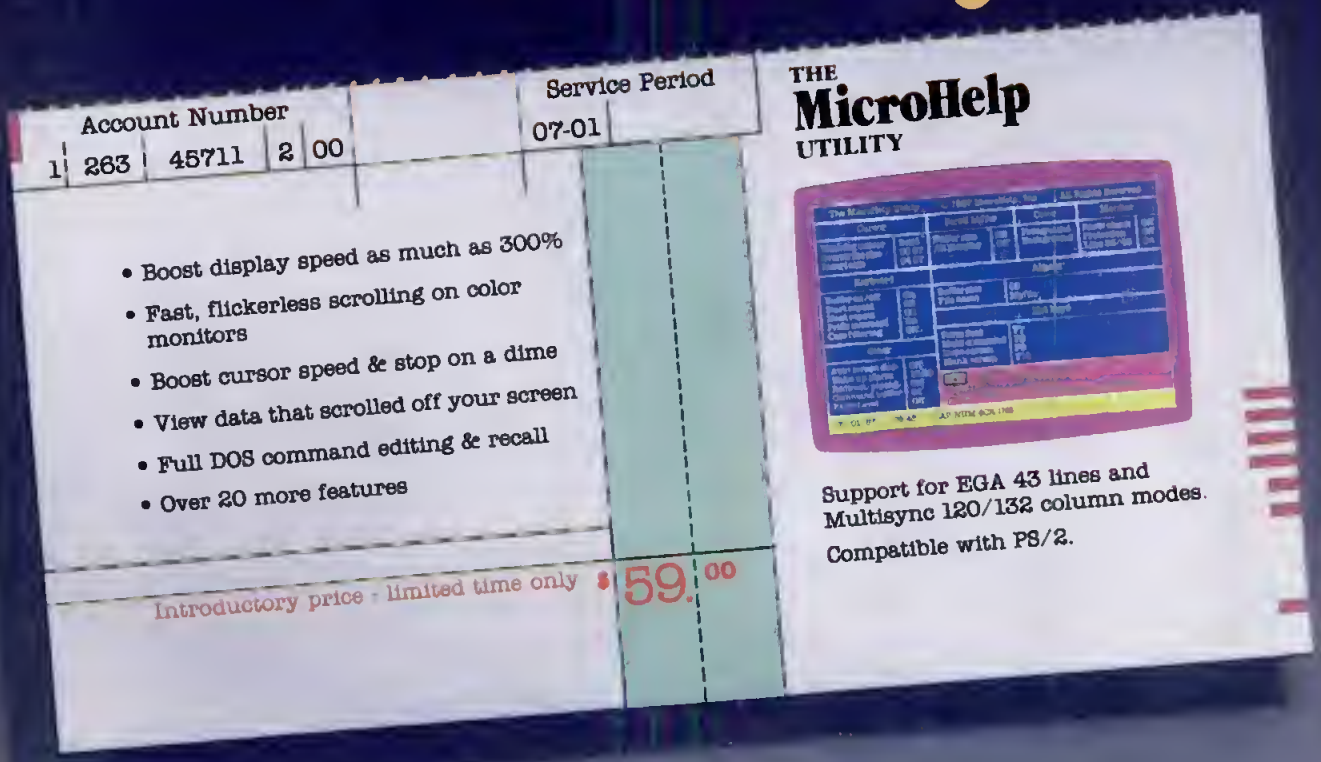

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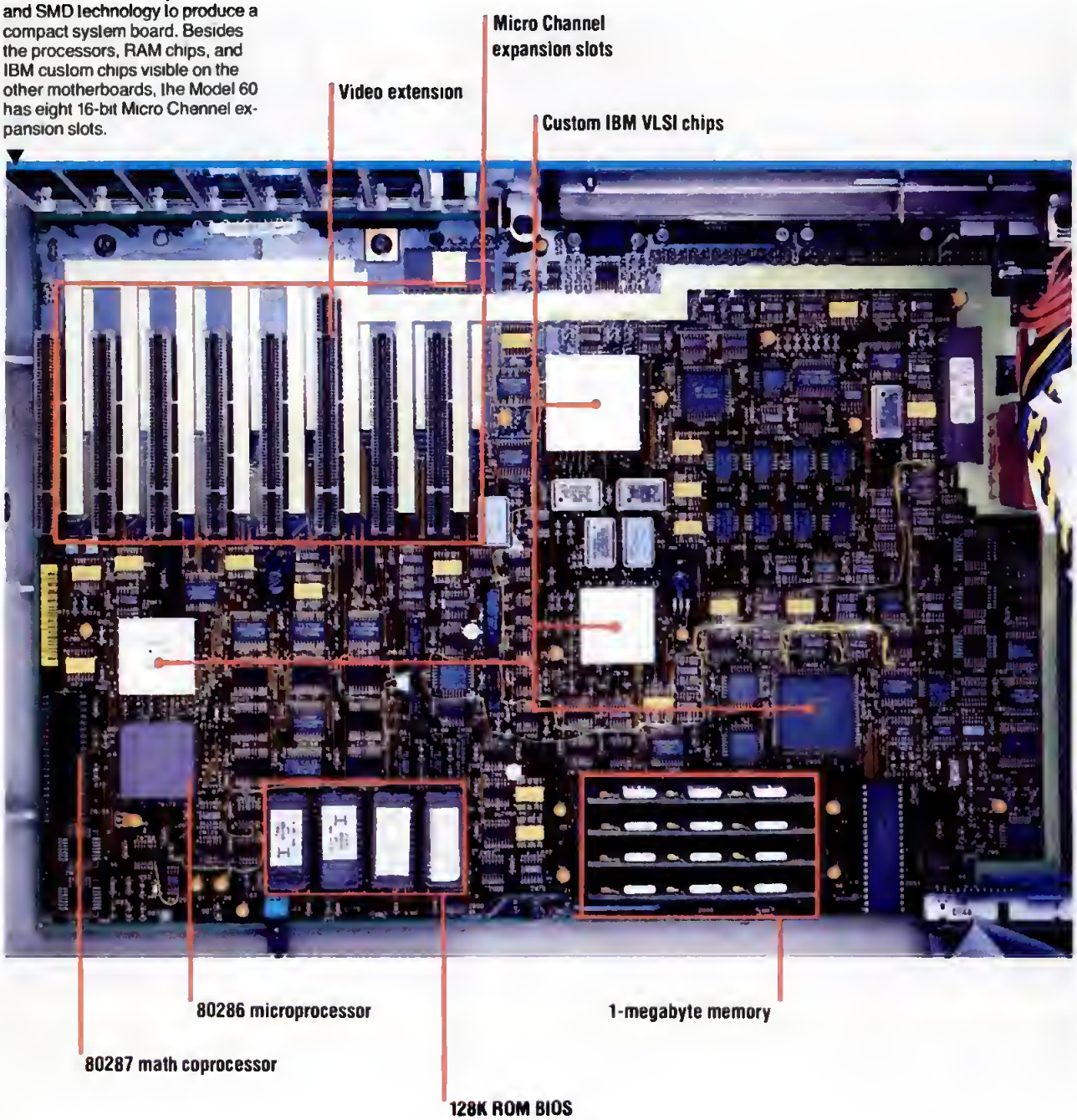
PS/2 Model 60

Like the Models 30 and 50, the Model 60 relies heavily on VLSI and SMD technology to produce a compact system board. Besides the processors, RAM chips, and IBM custom chips visible on the other motherboards, the Model 60 has eight 16-bit Micro Channel expansion slots.



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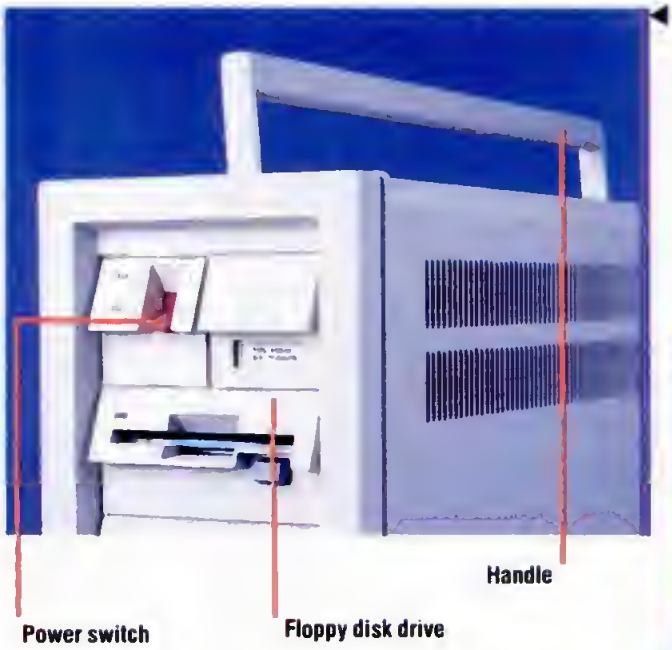
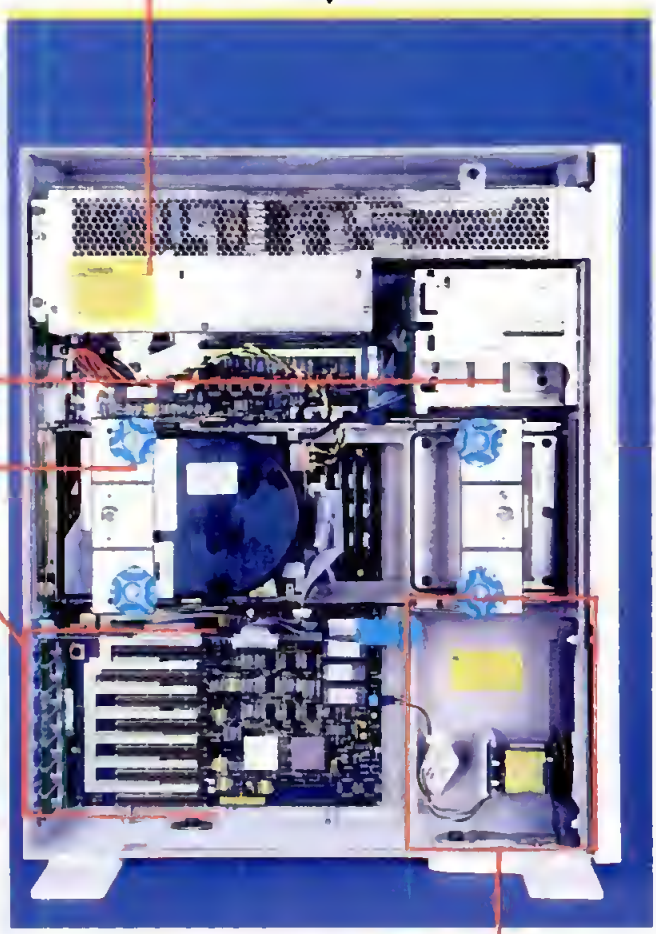
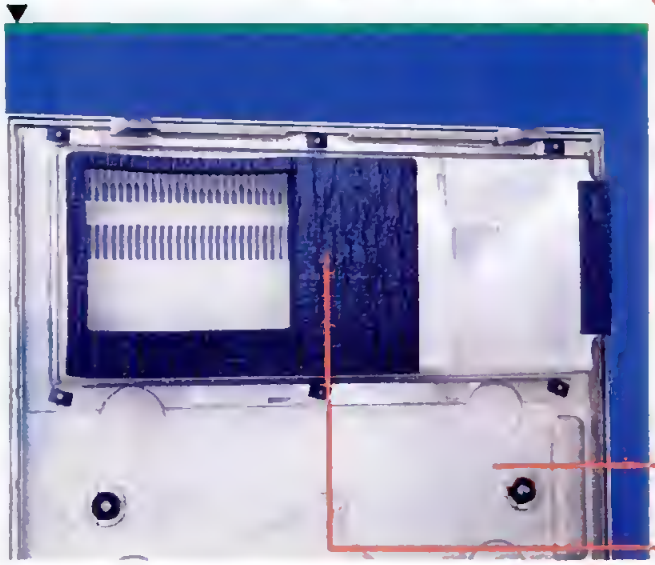


The Model 60 has the first IBM CPU designed to stand upright. Power switch and disk drives are easy to reach, and the handle lets strong users move the machine around.

Inside the Model 60, eight expansion slots share space with hard and floppy disk drives and the power supply. The cooling system (see below) fits over the empty space around the speaker.



The Model 60's cooling system sucks in cool air from outside the CPU and routes it to the top of the expansion card area. Once it has circulated around the expansion cards and drive bays, the air is expelled through the vents near the power supply.



electrically incompatible with it.

Not only is the standard Micro Channel card smaller than PC bus cards (11½ by 3 inches versus 13½ by 4), but the two rows of 58 pins of the Micro Channel bus are spaced more closely (on .05-inch versus .10-inch centers) and the connectors themselves are smaller. The signals assigned to each pin are also arrayed differently.

All eight of the Model 60 Micro Channel slots have access to the outside world through option-retaining brackets, including the single slot that's filled at the factory by the standard-equipment hard disk controller.

One of the slots is singled out for special treatment, boasting an extra 20 pins on the rear end of its system board connector. The extra pins are used for video signals so that add-in video coprocessors can cooperate with the self-contained display system built into the Model 60 motherboard.

The most important differences between the Micro Channel Architecture of the Model 60 (50 and 80) expansion and that of the PC and AT are concealed in its circuitry. The new design allows the Model 60 to handle several system functions more efficiently at the same time (or nearly so). Using a special bus arbitration scheme and up to eight DMA channels simultaneously, the Model 60 can move data between memory, disks, video, and I/O ports without any intervention by the microprocessor.

Note, however, that the multitasking abilities of the Model 60 won't be accessible until IBM's new Operating System/2 is released next year.

The new Micro Channel expansion cards are designed for tool-free installation and replacement. They are secured at the bottom rather than at the top by captive, knurled screws that can be finger-tightened and loosened, or, should they become reluctant, with the same coin used for opening the case.

Although the expansion area inside Model 60 looks capable of holding boards larger than the nominal IBM specifications—the case is a full inch taller than an installed Micro Channel expansion card—that extra space is used by the cooling system. A clear plastic plenum routes the air that's sucked in through the front panel of the Model 60 to the top of the expansion card area. From there, cool air from the outside is forced to flow around the expansion cards back toward the front of the computer, then up past the hard disk drive bays to the suction fan in the power supply, out of which the heated air is vented. Compared with the marginal ventilation of some previous PCs, cooling in the Model 60 system is elegant and effective.

The Model 60 enhanced expansion options as well as the extra 2K bytes of CMOS RAM give it an edge over the Model 50 in multiuser applications.

■ ■ ■ ■ ■

The video system built into the Model 60 system board adds a new acronym to the set display standards: VGA, which stands for Video Graphics Array. The new standard pushes on-screen resolution up another notch to 640 by 480 pixels in graphics modes and 720 by 400 in text modes (forming 80-column, 25-row displays with each character shaped inside a 9 by 16 matrix).

The top graphics resolution allows 16 simultaneous on-screen colors to be selected from a palette of 256 colors or from a degraded two-color (monochrome) mode. A new 320 by 200 graphics mode allows all 256 colors to be displayed on the screen at one time. The text mode color choice is 16.

The VGA system is completely compatible with software written for previous IBM standards including MDA, CGA, and EGA and provides similar on-screen performance. In its 200-line modes, however, the VGA system double-scans each line to increase the apparent on-screen sharpness of the image.

Because the new standard uses a horizontal frequency of 31.5 kHz, a noninterleaved mode-dependent frame rate of 60 or 70 Hz, and analog rather than digital signals, it is incompatible with all previous IBM personal computer displays and all but a few monitors from third-party suppliers. Four new IBM displays match the VGA standard of the Model 60—three color models, with 12-, 14- and 16-inch screens, and one paper-white monochrome.

Under the VGA standard, the color and monochrome monitors can be plugged in interchangeably, with the monochrome units displaying up to 64 shades of gray derived from the green of the color signal. The use of a different connector, one of them with 15 pins, prevents the potentially fatal, inadvertent attachment of an old-style display to the new system.

The VGA system uses a proprietary gate array rather than a video coprocessor. As a consequence, it does nothing to improve display speed over previous IBM systems. It adds only sharpness. Faster video is available using IBM's video coprocessor board, which gives image addressability up to 1,024 by 768 pixels.

Included with the Model 60 is IBM's 101-key enhanced keyboard with a generous 10-foot-long cord. In addition, the Model 60 system unit will support a mouse or other pointing device such as a trackball or touchpad. The odd-sized two-button mouse that IBM offers has a 9-foot-long tail.

EXPENSIVE EXPANSION The Personal System/2 Model 60 invites comparison with the Model 50. After all, both have the same performance and speed abilities, the same multitasking-oriented Micro Channel expansion bus, and the same built-in improved graphics abilities. You might think that the Model 60 is simply the Model 50 in a bigger box. But for all their functional similarities, the two Personal Systems wander in different directions in search of their own particular audiences.

The Model 50 is a single-user multitasking system with a footprint small

Case History #60341

"Arco Petroleum Products comes to mind," said Bill Kilpatrick, of The Software Works! of Glendale, California. "It was a big project. Arco had already been through two expensive failures with other companies who could not deliver the custom software they needed. It was a Point of Sale system, a cash register interface and custom-accounting software for their entire franchised chain of convenience stores, gas stations and auto tune-up centers. It had to be done fast and it had to work. Our competition proposed a dBASE III+ solution. We proposed DataFlex. I said, 'I'll make a challenge, if we can't deliver the completed project faster using DataFlex, following the exact specifications that have already been laid out, then Arco doesn't have to pay us a dime.' We knew we could do the job right and we knew we could do it faster with DataFlex."

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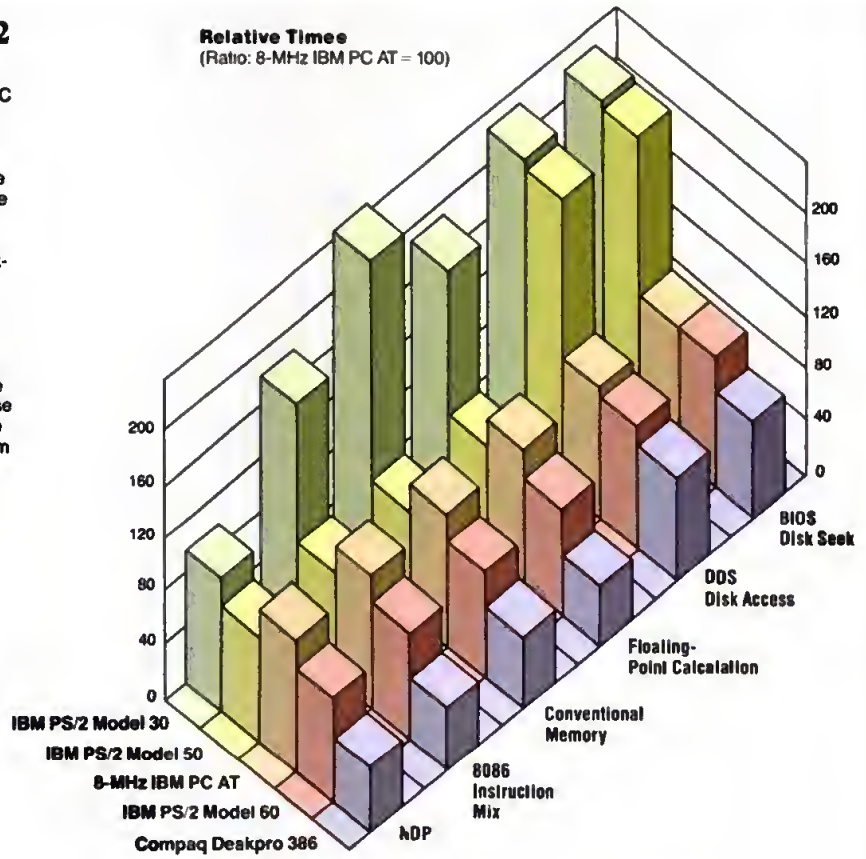
Benchmark Tests: IBM Personal System/2

In terms of operating times, the ancient IBM PC AT is still a viable contender despite the new PS/2 line's advanced technology. The PS/2 Model 30, with its 8086 processor, isn't even as fast as the AT. Although IBM claims that both the PS/2 Model 50 and Model 60 can run up to twice as fast as the AT, in our processor benchmark tests a 20 percent speed advantage was the norm. Performance times for the Compaq Deskpro 386 are included to show the speed of an 80386 processor in relation to the speed of the 80286 processor found in the faster PS/2 models.

Hard disk access results show that the PS/2 series' sluggish proprietary disks do little for the overall performance of the machines. In the case of the Model 60, the hottest setup may well be a hard disk with a 20-millisecond access time from a third-party supplier rather than IBM's AT-level drive with 35- to 40-millisecond access times.



Performance Times
(Times given in seconds except where noted)

	NOP	8086 Instruction Mix	Conventional Memory	Floating-Point Calculation (without coprocessor)	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)
IBM PS/2 Model 30	4.17	16.53	3.24	67.17	95.73	82.38
IBM PS/2 Model 50	3.35	7.30	1.03	28.34	92.93	61.02
8-MHz IBM PC AT	4.17	6.96	1.32	35.60	42.54	37.19
IBM PS/2 Model 60	3.35	7.25	1.05	28.18	39.58	36.76
Compaq Deskpro 386	2.09	4.23	0.72	15.50	33.32	27.03

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3, and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

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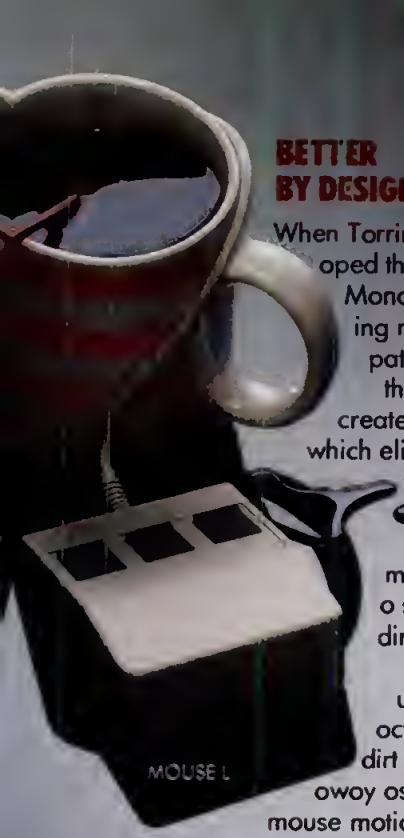

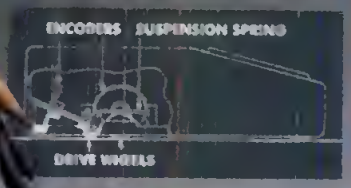

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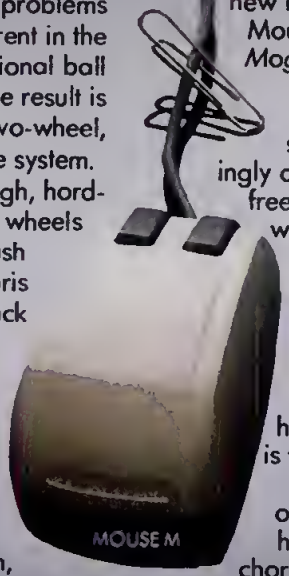

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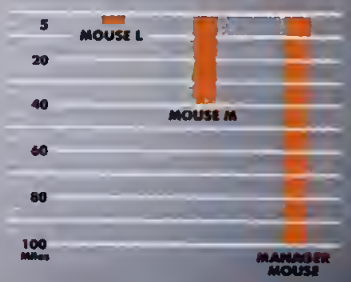

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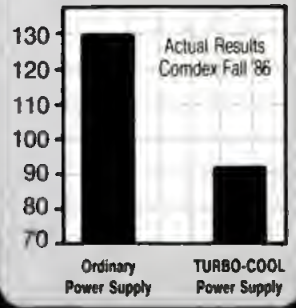

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enough to fit into a single desk drawer. The Model 60 enhanced expansion options—more slots and bigger drive bays—as well as the extra 2K bytes of CMOS RAM give it an edge in multiuser applications.

Even more than these features, however, price may be the best indicator of the place the Model 60 fits in the IBM Personal System/2 strategy. Although the Model 60 is a more expensive machine to make than the Model 50, if just for the labor involved, there can hardly be $1,700 worth of difference between the two models. Clearly the pricing of the two machines is more marketing than manufacturing in origin—$3,600 is in the range for single-user computers (a figure close to the price of the original XT, for instance), and $5,400 to $6,400 is in the multiuser range.

> Price may be the best indicator of the place the Model 60 fits in the IBM Personal System/2 strategy.

■ ■ ■ ■ ■

Certainly, the extra bucks buy a faster, larger standard hard disk, greater access to other mass storage options, a beefier power supply, and four additional 16-bit Micro Channel expansion slots. But with the difference between 20- and 40-megabyte drives on today's market only about $300 to $400, you end up paying a big premium of more than $300 per slot for a Model 60.

For a single user, those costly slots won't be very useful considering all the features packed onto the Model 60 system board. But for network servers and multiuser systems that need hundreds of megabytes of storage and scads of ports, the Model 60 will serve well.

Winn L. Rosch is a contributing editor of PC Magazine.

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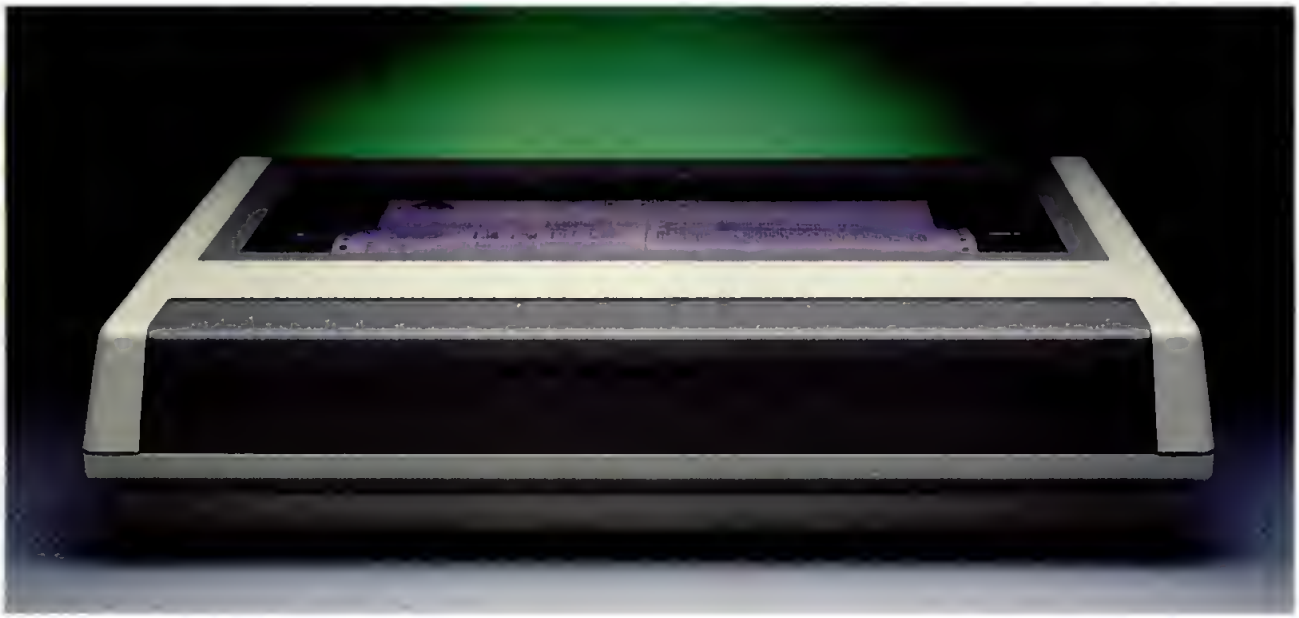

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BUS STOP

With the arrival of the Personal System/2 line, the PC has grown up. In the 80286 and 80386 PS/2 models, the standard bus has been replaced by sophisticated Micro Channel Architecture (MCA), providing a foundation that will take the machines into the next decade and perhaps beyond.

What was wrong with the old bus? Plenty. It's limited in its transfer rate. It's electrically noisy and tends to radiate RF interference. It's bulky. The sockets and card edge connectors are large and mechanically sloppy. It's graceless at sharing resources. And many of the signals are edge-triggered rather than level-triggered,

■ ■ ■ ■ ■

IBM's Micro Channel Architecture replaces inflexible bus systems and brings greater reliability, efficiency, and cooperation to hardware design.

which limits the upper speed of the bus and also contributes to errors.

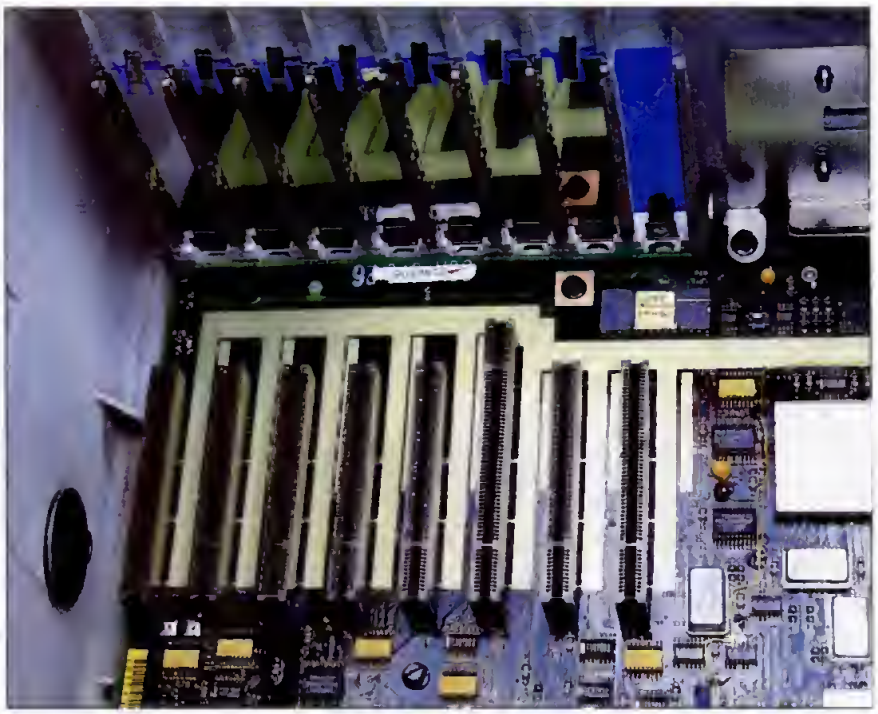
Unlike the PC bus, MCA is not specifically adapted to Intel microprocessors. Instead, it has a set of signals, rules, and protocols that allow multiple, dissimilar microprocessors to share it and work effectively with one another. Some of the other features increase reliability, while others ease configuration and reduce conflicts among devices.

UNIQUE IDENTIFIER CODES For example, MCA requires boards plugged into the bus to have unique identifier codes. The codes are built into the card when they're manufactured. All of IBM's enhanced small device interface (ESDI) hard disk controllers, for instance, have the same code. The 3½-inch disk controller found in the Model 50 has another code. A modem manufacturer might use one code for a 1,200 bits-per-second modem and another for a 2,400.

The device identifier codes are queried during IBM's new Programmable Option Select system (POS), which automatically configures computers in the PS/2 line, each time the machine is turned on. It can, based on the codes, include the necessary configuration files to run the hardware. Since all boards have a unique code, the software can also resolve potential installation conflicts.

IBM has ensured that the codes will remain unique. It has reserved half of them (32,767) for its own use and made the other half available to board manufacturers. IBM is currently the clearinghouse that issues the numbers, but if the job becomes too onerous (or if manufacturers object too strongly to tipping their hand to IBM) the task will be turned over to a third party, perhaps one of the industry standards groups.

The device identifier concept is not new. IBM mainframes had similar features 20 years ago. (MCA has many features adapted from IBM's mainframes and minicomputers. System/370 and Series/1 jocks will recognize much of the terminology and design.) The need, however, is more valid now than ever. Back then, the challenge was to coordinate the activities of a roomful, even a building full of equipment. Detecting errors in outlying devices was critical, as a malfunction could easily pull the whole system down or degrade performance drastically. The number and kind of devices that could be attached, however, were limited.



The new Micro Channel Architecture installed in the IBM Personal System/2 series is a vast improvement over the old PC bus. Each board plugged into the new bus will have a unique identifier code that can instruct the machine to run necessary hardware configuration files.

Photograph: Thom O'Connor

Not so with PCs. Almost any imaginable card could be designed for the new bus. Beyond the usual run of modems, memory, and I/O ports, there are coprocessors, special-purpose graphics boards, speech boards, real-world control boards, raster processors for laser printers, and more. Each board has a unique pattern of machine resource use. One will be heavily dependent on I/O ports. Another will require high-bandwidth memory transfers. Others will severely tax the interrupt service mechanism. And with some, the system will hardly know they're present.

Unique device codes open new fields of opportunity for diagnostics and system-level error detection, correction, and audit trails. The bus provides sufficient logic, for example, to build a truly fault-tolerant PC. Failing devices (cards or the equipment to which they connect) can be switched off the bus and others switched on in their place.

IBM strongly recommends against application software having anything to do with device identifiers, and DOS is utterly ignorant of their presence. This capability is currently a gleam in the eye of some programmer who will turn the Model 60 or the Model 80 into a knockout file server or communications hub.

The possibilities here are best illustrated by the current generation of network file servers. The PC AT is architecturally unsuited to being a file server. Its hard disk data transfer rate is too slow and the interrupt structure is too limited. We've even illustrated the point by putting a PC AT on a 3Com Ethernet network and comparing the AT's local access to its built-in hard disk to that of the shared hard disk. Access to the network drive is noticeably faster.

THE DMA BOTTLENECK Direct Memory Access (DMA), which is supposed to increase performance, is actually a bottleneck in the PC AT. The DMA chip

found in every PC and AT is actually a specialized microprocessor that knows how to do only one thing: move data from one memory location to another. Most computers have them.

The process is simple. You tell the DMA chip how many bytes you want to move, where they are, and where you want them to go. Then just let 'er rip. The DMA chip brings all other processes to a halt as it moves memory. Since it works so fast, in theory, you get the system back before you even know it was gone. In practice, however, long, recurrent DMA transfers have a negative effect on system throughput.

MCA has a solution. It offers eight channels of DMA (sufficient control registers to manage eight DMA transfers at the same time). In addition, it limits the time that a DMA channel can be active to 7.68 microseconds. It forces DMA to share system resources with other operations, including other DMA transfers. This shared activity is called bus interleaving. Even multiple DMA transfers can be interleaved. You can't manufacture clock cycles out of thin air, but overall system performance goes up with this technique.

One of the hallmarks of large mainframe computers is that they have considerably more than one processor. Yes, a single central processing unit bears the brunt of the computing, but it is aided by channel controllers, printer controllers, terminal controllers, and console controllers.

Each controller is a specialized computer, designed to relieve the main CPU of boring, repetitive tasks such as polling printers to see if they're ready to accept more characters. Even details such as printed form layout are typically handled without the knowledge or intervention of the mainframe CPU.

COOPERATIVE PROCESSORS In the Personal System/2 series, IBM uses more cooperative processors in the PC itself. The hard disk controller, for example, has an 8-bit microprocessor perform the drudgery of shuffling bits back and forth on the Micro Channel. Another microprocessor performs the same tasks for the system board's I/O ports.

Some cards have always had some native intelligence. The IBM/Sytek PC Network card, for example, had an 80186 processor, which made it a bit more powerful than its original PC-XT home.

The new bus, with its higher transfer rates, better arbitration, and better status signaling, invites coprocessing and distribution of tasks. You can be sure that future MCA products, especially those from IBM, will be rich in processors.

The Personal System/2 bus invites coprocessing and distribution of tasks.

■ ■ ■ ■ ■

The Micro Channel is also an inviting home for coprocessing. It accepts up to 15 bus masters, so specialized tasks may be carried out by dedicated processors.

Duplicating MCA may be the toughest challenge yet faced by clonemakers. IBM is still espousing open architecture. Indeed, virtually every one of the bus's specifications is published in the exhaustive *Technical Reference* manual. Schematics, however, are conspicuously absent. But the logic that controls the bus is locked away in custom VLSI chips, and there are as-yet uncharted potential interactions with the rest of the system that may make MCA tough to duplicate.

Also, IBM has identified upwards of 100 intellectually protectable concepts in the PS/2 line. It may apply for patents or copyright protection on any or all of them, which will no doubt touch off a wave of lawsuits and counterclaims. In the meantime, however, it may become just plain illegal to clone a PS/2 machine.

Compatible manufacturers continue to do a brisk business, but the balance will inevitably change as the PS/2 series takes hold. IBM has neither missed the boat nor missed the bus. PC

Bill Machrone is editor of PC Magazine.

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SMOOTH OPERATOR

Ever since the introduction of IBM's PC AT in 1984, people have been speculating about a new version of DOS that would take full advantage of the protected mode of the AT's 80286 microprocessor. Such an operating system, they said, would allow programs access to 16 megabytes of memory and provide real multitasking.

Three years later, Microsoft's Operating System/2 is finally within sight. Microsoft plans to make an OS/2 Software Development Kit available on August 1, 1987, and IBM has announced

■ ■ ■ ■ ■

The key to efficient multitasking, OS/2 will be the foundation of a new generation of computer software.

that it will begin retail sales of OS/2, Version 1.0, in the first quarter of 1988.

As expected, OS/2 multitasks new programs designed for its environment and uses the full 16-megabyte address space of the 80286 microprocessor. OS/2 also includes a DOS-like compatibility environment for running most existing DOS programs. Some people are saying that OS/2's rich and versatile applications program interface (API) will spawn a new generation of personal computer software, and it's tempting to agree.

OS/2 is the first announced product to be developed under the IBM/Microsoft Joint Development Agreement. This indicates a meeting of the minds between IBM and Microsoft concerning the functionality, applications program interface, and user interface of OS/2. Microsoft will also make OS/2 available to other original equipment manufacturers (OEMs).

The IBM version of Operating System/2 will run on all IBM machines built around the 80286 or 80386 microprocessor, including the PC AT, the XT Model 286, and the new Personal System/2 Models 50, 60, and 80. OS/2 will not run on 8088-based machines such as the PC and PC-XT, or 8086-based machines such as the PS/2 Model 30.

As is the case with Microsoft's MS-DOS today, versions of OS/2 will be configured by other OEMs (such as Compaq and Tandy) for their own 80286 and 80386 machines. When sold by OEMs other than IBM, Operating System/2 will probably be referred to as MS OS/2. Microsoft will not itself sell a retail version of the operating system.

Operating System/2 will eventually include a version of *Microsoft Windows* that will be called the "Windows Presentation Manager." Microsoft will be making some changes to *Windows* for its transition to OS/2. These changes will affect *Windows*' visual appearance, the keyboard interface, and (most significantly) the internal graphics interface.

The Windows Presentation Manager is an important component of OS/2 for end users, program developers, and IBM. To IBM, OS/2 and the graphics-based windowing environment of the Presentation Manager are part of IBM's Systems Application Architecture (SAA). This is an attempt by IBM to standardize applications program interfaces and user interfaces across IBM's entire line of computers. OS/2 is the first announced product to be part of this ambitious plan.

DIFFERENT VERSIONS OF OS/2 Part of the confusion surrounding OS/2 results from the various forms it will take. IBM has already announced three different versions of the operating system, and Microsoft has announced MS OS/2 with two components.

> The IBM version of OS/2 will run on all IBM machines built around the 80286 or 80386 microprocessor.

The main guts of OS/2 is called the OS/2 *kernel*. With the exception of low-level device drivers, the kernel will be essentially the same in all OEM versions of MS OS/2. The kernel handles file I/O, keyboard and mouse input, character-mode display output, multitasking, and interprocess communication. Initially, Microsoft will make only the OS/2 kernel available to OEMs. For IBM, this will be OS/2, Version 1.0.

Through the support of *dynamically linkable libraries*, OS/2 lends itself to the addition of various modules that extend the functionality of the operating system. Thus, Microsoft and Microsoft's OEMs (such as IBM) can add features to OS/2 while retaining compatible kernel functions.

One of the most important additions to OS/2 will be the OS/2 Windows Presentation Manager. Microsoft will make this component available to all OEMs, and IBM will include it with their OS/2, Version 1.1. Other OEMs may choose either to wait for the Windows Presentation Manager before selling OS/2 or to sell kernel-only versions of MS OS/2 during the interim. Although OS/2 will run without the Windows Presentation Manager, both IBM and Microsoft consider it an integral part of the operating system.

The second component of OS/2 that Microsoft will offer to OEMs is the OS/2 LAN Manager for local area network support. One interesting feature of the LAN Manager gives OS/2 software the ability to engage in interprocess communication across the network for distributed processing.

IBM, however, will be doing its own major add-ons to OS/2 to create the *OS/2 Extended Edition*. This version will include support for various mainframe communications and local area networks, and will have relational database capabilities based on IBM's Structured Query Language (SQL). Because these additions are originating from IBM, they will not be included in versions of OS/2 sold by Microsoft to other OEMs, or the versions of OS/2 sold by these OEMs to the public.

THE OS/2 COUNTDOWN These various components and versions of OS/2 will probably be released over the next year and half. Based on IBM and Microsoft announcements, the anticipated schedule looks like this:

On August 1, 1987, Microsoft plans to release the MS OS/2 Software Development Kit. With this kit, programmers can begin converting existing programs (or writing new ones) for OS/2.

The OS/2 Software Development Kit includes a beta-release version of the OS/2 kernel, over 2,000 pages of technical documentation, new protected-mode versions of Microsoft's C Compiler, Macro Assembler, *CodeView* debugger, and a full-screen editor, a 1-year subscription to Microsoft's DIAL technical bulletin board, attendance at an OS/2 technical seminar, and a subscription to *Microsoft Systems Journal* magazine.

The admission price for this orgy is $3,000. Direct telephone support costs an additional $1,000 per year. When the OS/2 Windows Presentation Manager and the OS/2 LAN Manager components become available, these updates (and

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others) will be distributed without additional cost to purchasers of the OS/2 Development Kit.

In the third quarter of 1987, Microsoft plans to release *Windows*, Version 2.0. *Windows* 2.0 really has nothing to do with OS/2; it runs in real mode under current versions of DOS. However, *Windows* 2.0 is a preview of the look and feel of the OS/2 Windows Presentation Manager.

The most dramatic change in *Windows* 2.0 is the use of *overlapping* rather than *tiled* windows for different applications. The menu works a little differently, and the keyboard interface has been enhanced. Most existing *Windows* programs will run fine under *Windows* 2.0. *Windows* 2.0 does not include the internal changes in the graphics interface that are being made for the OS/2 Windows Presentation Manager.

In the fourth quarter of 1987, Microsoft is scheduled to begin shipping the OS/2 kernel to their OEM customers. OEMs will probably begin selling retail versions of MS OS/2 to users a few months later.

IBM is scheduled to start selling retail versions of OS/2, Version 1.0, in the first quarter of 1988 at a cost of $325. Programmers who balk at Microsoft's $3,000 OS/2 Software Development Kit can get some less expensive technical documentation and abbreviated developer's kits from IBM at this time.

Microsoft expects to begin shipping the OS/2 Windows Presentation Manager to OEMs in the first half of 1988. Beyond that, the crystal ball starts to get a bit hazy. Although IBM has announced OS/2, Version 1.1, and the OS/2 Extended Edition, they put off specifying release dates until the fourth quarter of 1987. IBM's OS/2 1.1 update will be free to registered users of OS/2 1.0.

OS/2 AND THE USER Of course, people don't buy operating systems—people buy applications. The success of OS/2 will ultimately depend on the appeal it has for software developers and the extent to which these developers believe that OS/2 will eventually replace DOS as the standard operating system on 80286 and 80386 machines.

The first time most users will encounter OS/2 is when they are forced to, which is after buying a software package that says "Requires OS/2" on the box.

To the DOS user, much of OS/2 1.0 will be familiar territory. OS/2 uses the same command line interface as DOS. Most of the existing DOS commands have been duplicated. You can run OS/2 programs from the OS/2 prompt just as today you run DOS programs from the DOS prompt. The difference is that you don't have to wait for one program to end before you run another.

> OS/2 can maintain something like 16 screen groups, all with different programs running under them.

THE OS/2 SCREEN GROUPS An OS/2 session is divided into several *screen groups*. A screen group is a program (or a group of programs) that uses the whole screen. OS/2 can maintain something like 16 screen groups, all with different programs running under them.

OS/2 lets you switch between screen groups by pressing Alt-Esc. This clears the screen and displays the Session Manager menu. The Session Manager lists all current screen groups identified by the names of the programs currently running in them. You can then use the cursor keys and select a different screen group. OS/2 clears the screen of the Session Manager and displays the screen group of the selected program. You can also bypass the Session Manager and flip between screen groups by holding down the Alt key and pressing Esc twice in succession.

The relationship between the Session Manager and the screen groups is shown in Figure 1.

From the Session Manager you can create a new screen group by selecting the "Start a program" option. This option loads a new copy of CMD.EXE, which is the protected-mode command processor that serves the same function as COMMAND.COM in DOS. From CMD.EXE's prompt, you can run other OS/2 programs.

Most users will find the Session Manager useful for quick *context switching*—to get from one program to another without continually exiting and reloading the applications. This is perhaps the simplest use of OS/2.

Besides context switching, users can also take advantage of multitasking. Each screen group is almost like a separate PC. For instance, a database program can be sorting a lengthy file, while a communications program can be downloading electronic mail, while the FORMAT command can be formatting a diskette, while you're working on a memo.

Of course, if you're already familiar with RAM-resident pop-ups and background communications programs that run under DOS, context switching and multitasking may not appear so revolutionary.

This is true. But there are some very significant differences with OS/2: OS/2 does all these procedures with the help of the 80286 microprocessor, which means that OS/2 does it safely and efficiently. OS/2 takes care of the memory management, file locking, and task isolation necessary under a legitimate multitasking environment. Under real-mode DOS, multitasking is essentially a precarious proposition.

DOS COMPATIBILITY BOX One screen group is called the "DOS Compatibility Box." The word *box* is a misnomer because it sounds like a little window on the screen. It's not. The DOS Compatibility Box is simply a screen group that runs in real mode. It sets forth an environment to run existing DOS programs in the lower 640K of memory. Most existing DOS programs will run in the OS/2 DOS Compatibility Box.

Users can easily switch between the DOS Compatibility Box and protected-mode screen groups using Alt-Esc. Programs running in the protected-mode screen groups continue to run even when

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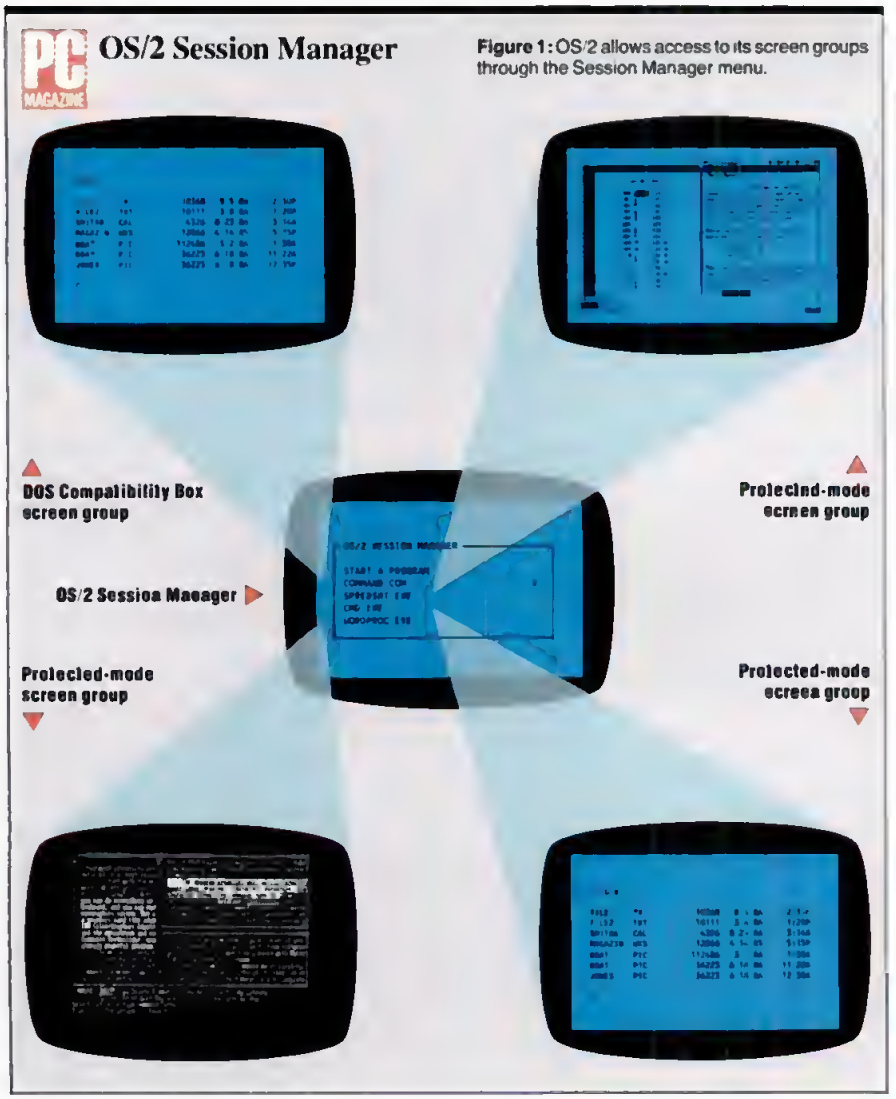

Figure 1: OS/2 allows access to its screen groups through the Session Manager menu.

the DOS Compatibility Box is visible. (OS/2 has to switch back and forth between real mode and protected mode to do this.) However, programs that are running in the DOS Compatibility Box are suspended when the Session Manager or one of the protected-mode screen groups is visible on-screen.

For the most part, existing DOS programs do not gain anything from running in the DOS Compatibility Box over what they can do under current versions of DOS. OS/2 supports only one DOS Compatibility Box and does not attempt to multitask existing real-mode programs. The DOS Compatibility Box is essentially isolated from the protected-mode screen groups. For instance, you cannot pop up a real-mode RAM-resident program while a protected-mode screen group is visible.

However, some protected-mode programs can add a little functionality to the DOS Compatibility Box. One of the programs included with OS/2 is a print spooler that buffers printer output from both the protected-mode screen groups and the DOS Compatibility Box. The spooler is smart enough to separate printer output into jobs and not mix up output from the different screen groups.

OS/2 also guards against some possible conflicts between protected-mode and real-mode programs. For instance, if a protected-mode program is using one of the RS-232 communications ports, OS/2 can make it appear to real-mode programs as if the communications port is not installed. Likewise, if OS/2 detects that a real-mode program is using the communications port, it will make the port unavailable to protected-mode programs.

OS/2 also locks files that either protected-mode or real-mode programs are using so that other programs can't alter them. (This network-type file sharing and locking is absolutely essential in a multitasking environment.)

Normally, OS/2 will allocate the lower 640K of memory for the DOS Compatibility Box and use memory above 1 megabyte for the protected-mode components of OS/2 (as shown in Figure 2). However, statements in the CONFIG.SYS file can reduce the amount of memory available to the DOS Compatibility Box or eliminate it entirely in order to use all system memory for protected mode.

THE ADDITION OF WINDOWS The addition of the Windows Presentation Manager to OS/2, Version 1.1, will add a graphics-based windowing environment to the operating system. The Presentation Manager will itself be a separate screen group that runs multiple programs.

Programs specially written for OS/2 *Windows* will be displayed in separate windowed areas on the screen. Users can switch between programs using the keyboard or a mouse and transfer data among them. Programs written for *Windows* have a consistent user interface and take advantage of *Windows*' device-independent graphics interface.

OS/2 *Windows* will also be able to window most character-mode programs that run under the non-*Windows* OS/2 kernel.

THE LIMITS OF COMPATIBILITY The DOS Compatibility Box is not free of problems. Some of the problems arise because DOS programs must be suspended when the user switches to a pro-

tected-mode screen group. Programs running in the DOS Compatibility Box will not even get any hardware interrupts during this time. This situation has the most serious effect on RS-232 communications programs. These programs will lose incoming data following a switch to a protected-mode screen group.

Programs that depend upon some undocumented DOS function calls and absolute memory locations of internal DOS tables may also stumble. This dependence may affect some network software and some RAM-resident programs that intercept DOS file I/O calls.

Ironically, one of the few programs that do not run in the OS/2 DOS Compatibility Box is *Microsoft Windows* 1.03. It turns out that *Windows* has too intimate a relationship with undocumented DOS function calls. Bad, bad, bad. Microsoft has stated that *Windows* 2.0 *will* run in the DOS Compatibility Box. It had better.

When switching back to a DOS Compatibility Box, OS/2 may not be able to reconstruct the entire previous screen image. This mostly affects programs that use the EGA in graphics modes. OS/2 cannot determine the entire video state because EGA registers are read-only. (Fortunately, IBM has started to build hardware with this problem in mind: all video registers in the new PS/2 VGA video adapter can be read by software.)

PROBLEMS WITH BLOCK DEVICES

Perhaps the most serious compatibility problem between DOS and OS/2 concerns installable block devices, which include some hard disks and tape drives.

The OS/2 protected-mode screen groups and the DOS Compatibility Box share the same file system. Device drivers for block devices have to run in protected mode. If the device driver does not run in protected mode, then the driver cannot be installed for use either in protected mode or in real mode.

While IBM's version of OS/2 will handle standard IBM disk drives, users of some non-IBM block devices on IBM machines may have problems. Users with add-on mass storage devices that require special drivers (usually specified in DEVICE lines of a CONFIG.SYS file) will not be able to install those devices. The driver file will have to be replaced by the manufacturer. A healthy chunk of Microsoft's OS/2 Development Kit is devoted to writing OS/2 device drivers.

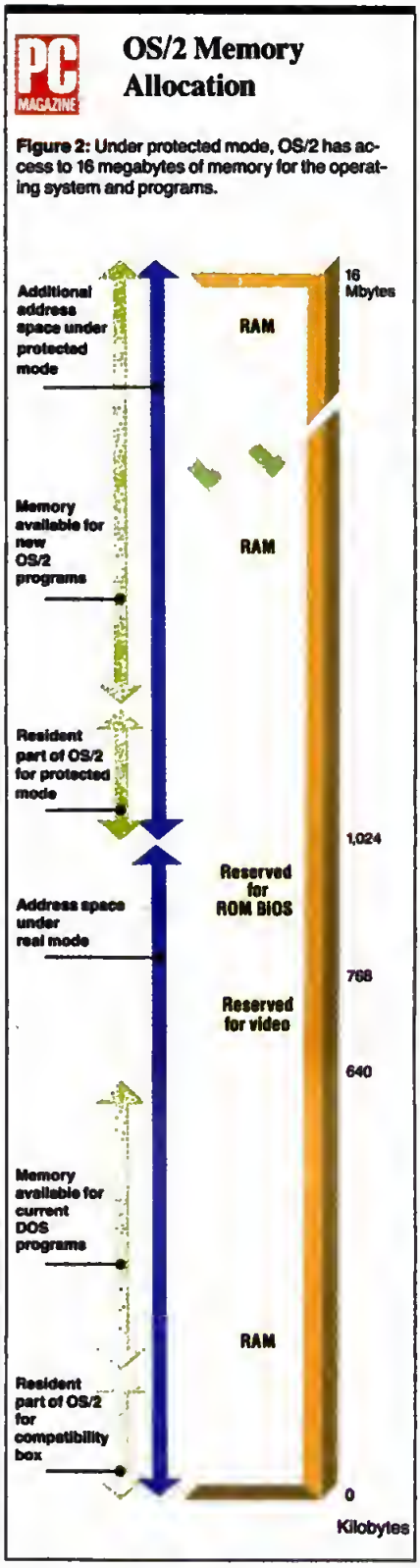

Figure 2: Under protected mode, OS/2 has access to 16 megabytes of memory for the operating system and programs.

When running in protected mode, OS/2 cannot take advantage of ROM BIOS code that normally masks hardware-dependent code from DOS. OS/2 has to duplicate all the ROM BIOS functions in its own drivers. (The PS/2 Models 50, 60, and 80 have ROM BIOS routines that can run in protected mode; hence OS/2 does not need to duplicate this code.) OS/2 may not be able to use a non-IBM hard disk controller card if it's not hardware compatible with the IBM board; it may also have problems with a non-IBM replacement ROM BIOS installed in an IBM controller card. Again, this is an area where the hard disk manufacturers have to provide software updates for users.

WHAT OS/2 GIVES PROGRAMMERS

When programmers whose experience is limited to DOS first crack the manuals of the Microsoft OS/2 Software Development Kit, they will discover what a real operating system is all about.

Briefly, here are some of the OS/2 kernel features:

- In protected mode OS/2 can use up to 15 megabytes of memory (and more if the DOS Compatibility Box is limited in size or eliminated). Protected mode allows OS/2 to move code and data segments in memory and to use the same code segments for multiple instances of a program.
- OS/2 implements virtual memory; hence programs can allocate more memory than is physically present in the machine. OS/2 swaps memory to the hard disk based on a least-recently-used algorithm. In protected mode, the CHKDSK command doesn't even list total memory or free memory space because these figures have much less meaning than under real mode.
- OS/2 implements 80286 memory protection that effectively insulates programs and the operating system from a "runaway program" or any other occurrence that under real mode would probably crash the system.

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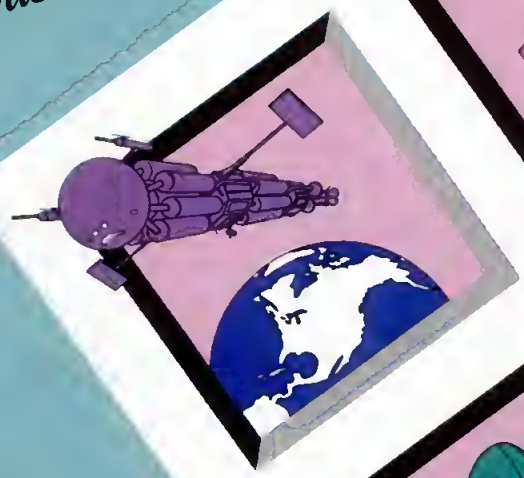

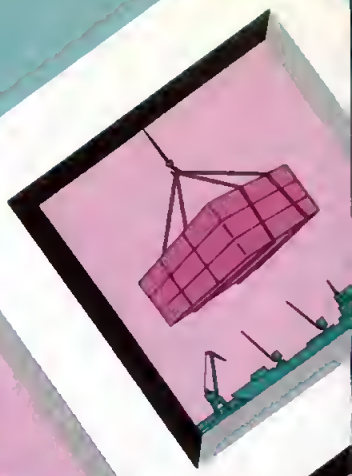

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■ OS/2's memory management includes provisions for shared memory blocks and "huge" memory blocks (blocks that are greater than 64K).

■ OS/2 efficiently multitasks programs. In protected mode, the 80286 hardware performs clean task switches. A program can execute another program in an asynchronous mode; the two programs can then run simultaneously. Programs designed to run in the background can exit back to the parent process and remain resident and running. A new OS/2 command called DETACH can run any program in the background (although programs that write to the display or require keyboard input may not be suitable for such treatment).

■ Programs can set up multiple threads of execution, allowing various sections of the program to run simultaneously. The program can assign the threads different priorities or temporarily suspend them. Threads can synchronize operation with each other through use of semaphores.

■ OS/2 programs can take advantage of system-supported interprocess communication and data sharing, either in the form of a pipe (which is somewhat similar to a DOS pipe) or a queue, which involves shared memory segments and can be priority based. Cooperating programs can synchronize message passing among themselves through the use of system semaphores and signaling.

■ OS/2's file I/O calls support file locking and file sharing. The OS/2 system call to open a file has seven sets of flags that designate various types of sharing modes, access modes, and inheritance modes, and indicate how critical errors should be handled.

■ OS/2 provides system calls to replace the direct access of hardware common in today's DOS programs. The OS/2 kernel does its own RS-232 buffering, has a complete mouse interface, and contains a very rich (and very fast) set of character-mode video I/O routines. (Graphics, however, is a problem. Programs that use graphics are better suited for the OS/2 Windows Presentation Manager.)

■ OS/2 includes a character-device "monitor" system for programs to intercept such things as keyboard input and printer output. Programs running in the background can use this to define hot keys similar to those of today's RAM-resident programs. (However, popping up on top of a running program may be a problem. The program underneath the pop-up is not suspended, as it is in DOS, and continues to run, possibly overwriting the area occupied by the pop-up. Pop-ups are best suited for the Windows Presentation Manager, where *every* program is a pop-up.)

■ OS/2 supports dynamic linking. This allows programs to use shared code stored in external library modules. The code is demand-loaded based on the needs of the program.

■ OS/2's timer facilities allow a program to be suspended and "sleep" for a set period of time. Of course, other threads in the program can continue to run during the suspension.

■ OS/2 includes a screen message facility to obtain text messages (such as "File not found") from a common file. This facilitates the adaptation of programs to foreign languages.

On top of this, programmers can also write applications for the OS/2 Windows Presentation Manager to take advantage of device-independent display and printer graphics, and a wealth of built-in routines for menus, dialog boxes, scroll bars, and so forth.

For compatibility reasons, OS/2 retains the same file system used by DOS. This old file system (the strongest part of DOS) is perhaps the weakest part of OS/2. Under OS/2, we are still stuck with the same 32-megabyte limit on hard disks. Under OS/2, we still have files that are identified by only an eight-character name and a three-character extension. Replacement of this file system now becomes one of the highest-priority enhancements to OS/2.

THE DIFFERENT ENVIRONMENTS

With the introduction of OS/2, programmers will have the choice of five different DOS-derived environments in which to program for the PC and PS/2 machines.

1. The DOS 2.*x*/3.*x* environment: programs that use DOS interrupt 21h and other software interrupts and directly access the computer hardware. These programs will run under current versions of DOS and in the OS/2 DOS Compatibility Box as well.

2. *Microsoft Windows* running in real mode: These programs use the *Windows* API (applications program interface) for most tasks and DOS interrupt 21h for file I/O. They will run under existing versions of *Windows* under DOS 2.*x* and 3.*x* and *Windows* 2.0 in the OS/2 DOS Compatibility Box.

3. OS/2: These programs use the OS/2 API. They cannot run under DOS 2.*x*, 3.*x*, or the DOS Compatibility Box.

4. OS/2 Family API: This is an interesting one. Programs that use only a subset of the OS/2 API (specifically those function calls that can be duplicated in real mode) can be linked with a special library to create a dual-mode .EXE file. When run under protected mode, the program uses the normal OS/2 API. When run under real mode, routines from this special library convert all the OS/2 calls to equivalent interrupt 21h calls, BIOS calls, or direct hardware accesses. These programs will run under OS/2 in protected mode, the OS/2 DOS Compatibility Box, and DOS 2.*x* and 3.*x*.

5. OS/2 Windows Presentation Manager: These programs use the API of OS/2 and the OS/2 Windows Presentation Manager. They cannot run under DOS versions of *Windows*.

The choice between programming for straight OS/2 or the OS/2 Windows Presentation Manager will probably be based mostly on whether the program uses graphics. The straight OS/2 environment is excellent for full-screen programs that do not use graphics. Although graphics applications can be programmed to run outside the Windows Presentation Manager, *Windows* is a more hospitable environment for graphics applications.

The OS/2 Family API will be used mostly for programs that make relatively simple use of the operating system. For instance, the compilers that Microsoft will release for OS/2 are Family applications.

The difference in the graphics interface between DOS *Windows* and OS/2 *Windows* will probably require develop-

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ers to maintain separate source code files for these two environments. This is not the way it was supposed to be. *Windows* was supposed to provide smooth sailing between real mode and protected mode. Indeed, *Windows* was sold to software developers partially on the basis of that argument.

The changes that Microsoft is making to the *Windows* graphics interface are required because *Windows* will play a very significant role in IBM's emerging Systems Application Architecture. Essentially, *Windows*' graphics interface will be made compatible with IBM's GDDM graphics system. One long-term advantage is that programmers someday will be able to recompile their OS/2 *Windows* programs to run on IBM systems other personal computers.

WHAT ABOUT THE 80386? Although OS/2 will run on 80386 machines, it does not take advantage of the 80386's 32-bit addressing space. Even on an 80386, OS/2 is still limited by the 64K segment limit (although programs can get around that somewhat through the use of "huge" memory segments) and a 16-megabyte address space (although the use of virtual memory can make it seem much larger).

The good news is that Microsoft intends to move the OS/2 API into a future 80386 version. Actually its plans are more ambitious than that: Microsoft is hoping that the foundations established by OS/2 will carry personal computer software through the next decade, which means almost through the end of the century. We shall see.

The next year or two should be interesting. Nobody can guarantee that OS/2 will replace DOS as the standard operating system on 80286 and 80386 machines. In fact, a change such as this represents such an upheaval that it's hard to imagine it actually happening.

But what's even harder to imagine is the IBM-compatible personal computer industry limping into the 1990s still burdened by the outdated and inadequate operating system known as DOS. PC

Charles Petzold is a contributing editor of PC Magazine.

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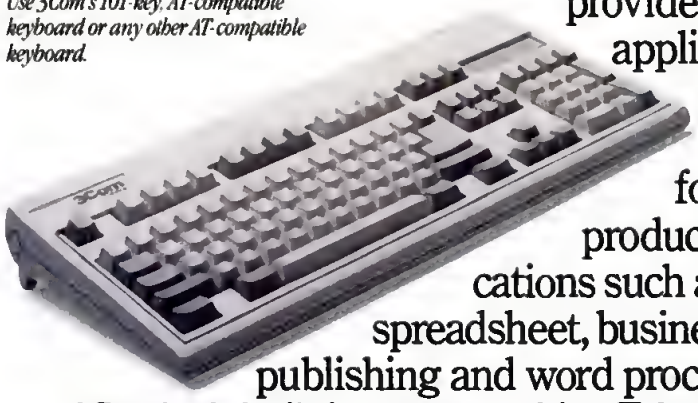

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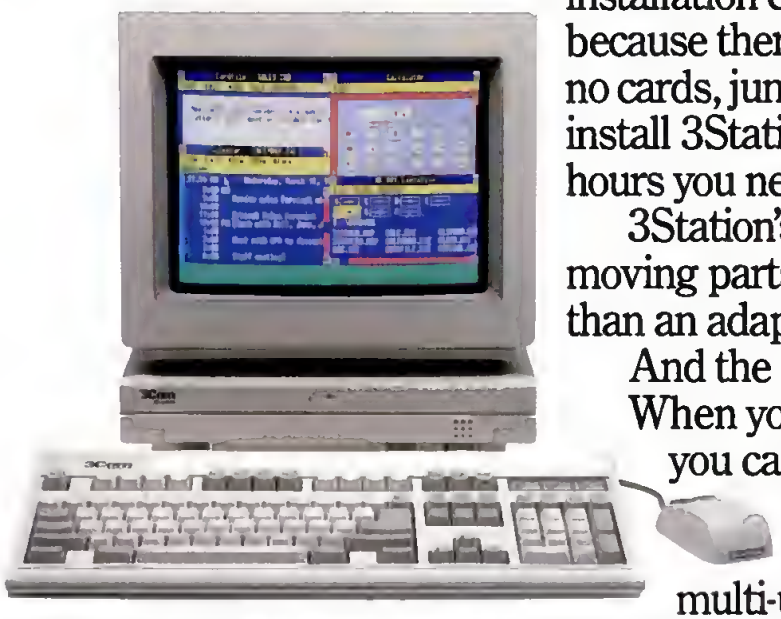

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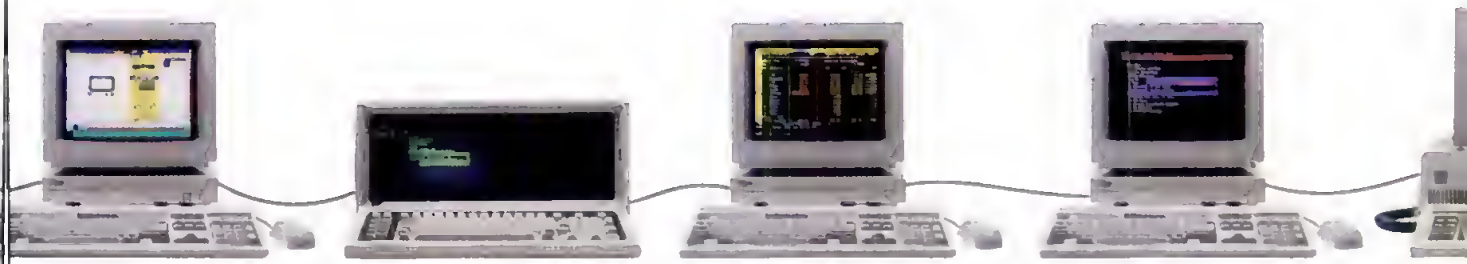

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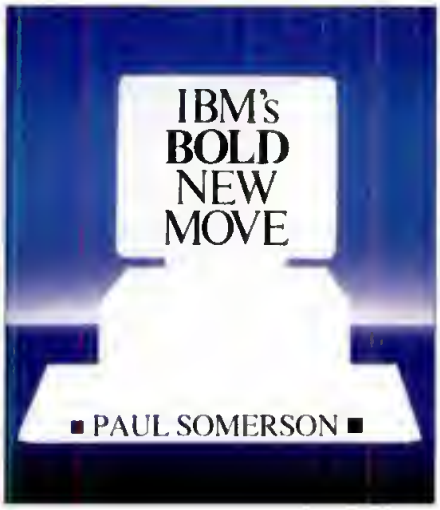


DOS LIVES

IBM's recent Personal System/2 press event teemed with exuberant pitchmen preaching how OS/2 would allow true multitasking, solve memory problems, cure warts, grow hair, and assure world peace. DOS 3.3 was tossed off merely as an "interim solution" for serious hardware, and the operating system for a string of dogs including the PC Convertible, Portable PC, and PC*jr*. Even the "IBM Personal System/2 Data Migration Facility," a $33 rubber plug, garnered more attention.

Which is a shame, considering that OS/2—aka DOS 5,

■ ■ ■ ■ ■

OS/2 is getting all the attention these days, but there's still a lot of life left in DOS. Version 3.3 offers quite a few new features, including the APPEND command you've been anticipating.

ADOS, and CP-DOS—won't be ready until next year, won't yet have its sexy *Windows*-like user interface when it first hits the shelves, and will set buyers back a hefty $325. For the vast majority of users the real operating system news is IBM's significantly beefed up DOS 3.3.

OK, Version 3.3 isn't a wholesale redo like the leap from 1.1 to 2.0. But apart from the obvious upgrades, such as understanding the new 1.44-megabyte diskettes, it deftly excises a heap of user headaches and adds a few sizzling new tricks. It also takes up a lot more real estate (see "Comparative Sizes of IBM DOS Versions").

PATH FINDERS The new feature users have been screaming for the longest is APPEND. Since Version 2.0 you've been able to tell the DOS PATH command which subdirectories to check for executable files (ending in .COM, .EXE, or .BAT). But nonexecutable files remained immune to even the most comprehensive search.

DOS executes "internal" commands such as DIR or VER or TYPE directly, since the instructions for these are embedded inside COMMAND.COM. If DOS doesn't recognize the command you typed, it first checks the current directory (if you entered something like CHKDSK) or any directory you may have specified (if you typed something like D:\BIN\CHKDSK). It then looks in each of the subdirectories that you included in your PATH. So if you added a line somewhere in your AUTOEXEC .BAT file that read

```
PATH C:\;C:\DOS;D:\
```

if DOS didn't immediately find the file you specified it would hunt for one by that name with a .COM, .EXE, or .BAT extension in the root and \DOS subdirectories on drive C:, and in the root directory on drive D:.

However, if you needed to find a file that had an extension other than .COM, .EXE, or .BAT, you had to purchase a "path extender" program such as *FilePath* or *File Facility*. Or, if you were working with DOS 3.1 or 3.2, you could use the SUBST command to trick DOS into thinking a subdirectory was actually a "logical" (rather than physical) drive with its own drive letter.

For example, the main *WordStar* 3.*x* WS.COM file always needs to know where you've stored its two .OVR overlay files. If these files were kept in C:\PROGS, you could use DEBUG to patch WS.COM so that it looked for the overlays on drive E:

```
DEBUG WS.COM
E 2DC 5
W
Q
```

and then tell DOS all about it with

```
SUBST E: C:\PROGS
```

(For anything higher than drive E: you also had to add a LASTDRIVE command to your CONFIG.SYS.) If your MEMO file was stored in C:\STAR\WORK and you had used SUBST to turn that subdirectory into F:, you could then type WS F:MEMO.

APPEND makes the process relatively easy—and a lot cleaner. Just follow the PATH command in your AUTOEXEC.BAT file with an APPEND command using similar syntax and telling DOS where your important nonexecutable files are located. If you keep overlays in the subdirectory mentioned above and correspondence with royalty in \KING\LTRS, your APPEND command could be

```
APPEND C:\PROGS;C:\KING\LTRS
```

DOS gives you two ways to keep tabs on your APPEND list. You can start off with an extra APPEND /E command, which loads APPEND strings into your environment and lets you change them with the SET command, just as with PATH. But if you or your programs switch command processors (by loading a secondary one or exiting the one you're currently using), such strings become inaccessible. With long PATH and APPEND strings, you may have to expand your environment size by using the SHELL command. In fact, these days the default 160-byte environment is straining at the seams.

You can also add an additional APPEND /X command to spiff up the way DOS looks for files. Or you can add both /E and /X, but you then have to run APPEND twice—first with any switches and then with the actual list of subdirectories DOS will search.

The DOS manual contains all sorts of dire warnings on using APPEND with BACKUP and RESTORE, running it with ASSIGN, or having it anywhere near the similar IBM LAN commands. And as with any path extender, you have to be careful that you're not accidentally pulling in a long-forgotten file from a distant subdirectory that APPEND knows about but that you don't.

DOS DELIGHTS Other long-sought enhancements let MODE address four serial ports rather than just two (OS/2 can juggle up to eight) and cruise along at up to 19,200 bits per second. With the profusion of modems, mice, oddball printers, digitizing devices, and cheap LANs, this is more than welcome.

And finally IBM has recognized that at least twice a year users need to reset their internal IBM clocks without having to hunt down their Diagnostics disks, figure out which option adjusts the time, and then grind through all the irritating screens necessary. The 3.3 TIME and DATE commands automatically reset IBM CMOS memory to reflect the change.

Another handy little improvement is the newfound ability of ATTRIB to gang-process all files in a directory and any subdirectories hanging off of it, with a simple /S switch. Unfortunately, however, ATTRIB still won't hide or unhide files. But it's now slightly easier to fiddle with large numbers of archive bits to make backups easier or make all the files in related subdirectories read-only to prevent inadvertent deletions or changes.

In earlier DOS manuals, STACKS was stuck on a lonely page way in the back. Under 3.3 it's moved up front where it belongs. Earlier 3.*x* versions had a bad habit of crashing if users banged on the keyboard too rapidly, and you needed to set STACKS properly to make the repair. DOS 3.3 also lets you disable STACKS entirely, if you want. Unfortunately, the explanation isn't unduly helpful.

BIGGER AND BETTER Now that larger hard disks are becoming popular and IBM has introduced drives that can soak up 44, 70, and 115 megs, it has tuned DOS to divide the physical units into smaller "logical" drives DOS can handle. FDISK can now create "extended" DOS partitions in addition to the "primary" ones you were able to carve out previously. Each extended partition can further be subdivided into logical drives 32 megabytes or smaller with their own drive letters.

FDISK assigns drives for you automatically and has priority over other drive-creating devices, such as VDISK, in assigning drive letters.

You can shoehorn hundreds of subdirectories and several thousand files onto a 32-meg drive. And, either by using SUBST to pare down long subdirectory names into single drive letters or by brute-forcing the size of your environment larger with SHELL, you can make your PATH and APPEND /E searches truly formidable.

However, asking DOS to churn through several dozen hefty subdirectories each time it looks for a file can make your system really drag its feet. To expedite things, DOS 3.3 provides a filename cache utility called FASTOPEN. Once you've told FASTOPEN how large a cache to maintain (from 10 to 999 entries, with a default of 34), each time you jump into a subdirectory or open a file, DOS records the on-disk location. Subsequent requests are far faster, since DOS will know exactly where to look.

Since each entry chews up 35 bytes, long searches can slog through FASTOPEN tables as large as 34K, slowing things down. But if you specify too few and exceed the number, FASTOPEN starts tossing the entries for the least recently used files. And this won't work with pseudodrives created by JOIN, ASSIGN, or SUBST, or on networks. But it shows that IBM is finally thinking big.

IBM is also making backups slightly more efficient. DOS 3.3 now lumps all BACKUP data into one large file on the target disk, eliminating wasteful slack space and accelerating the process. An additional CONTROL file tells DOS how to slice up the file later when restoring things. The new BACKUP can log its activity to the source disk and archive your files based on time as well as date. Best of all, it won't restore old IBMBIO .COM and IBMDOS.COM hidden system files on top of newer, updated ones—and it *will* FORMAT disks on the fly if you ask it to. Previous versions forced you to format a tall stack of floppies before you started—and if you ran out in the middle of backing up you were out of luck. However, it does this by running a copy of FORMAT.COM from out of BACKUP.COM, which is a clanky way to go.

IBM has tuned DOS to divide hard disk drives into smaller "logical" drives DOS can handle.

■ ■ ■ ■ ■

BATCH MAGIC Two overdue DOS 3.3 batch file enhancements should prove popular. The first thing most power users do in a batch file is turn ECHO OFF to stop the batch file's commands from displaying on-screen as they execute. But the ECHO OFF command itself added to the screen clutter. Now, simply by prefacing any command with an @ symbol, you can inhibit its appearance.

This won't prevent DOS from printing messages such as "1 File(s) copied." The way to suppress these is to add a >NUL after any DOS command that would normally generate a message on-screen. If you really want to shut things down, you can sandwich any potential screen-clutterers between the lines

```
CTTY NUL
```

and

```
CTTY CON
```

but be careful. Since CTTY NUL effectively disconnects your keyboard and screen from what's going on, unless you're absolutely certain that the batch file is going to make it back to the restorative CTTY CON line, you're playing with fire.

The other smart 3.3 batch fixup is the ability to CALL an additional batch file, execute it, and then return to the original batch file and continue executing it. Previous editions of DOS let users nest batch files by running them out of additional command processors (with COMMAND /C). But this had environment drawbacks and ate up space.

If you want to have DOS list all the files in a subdirectory for you and then ask whether or not you want to delete each, you can do it with CALL and a tiny ERRORLEVEL setting routine called GETYES.COM that simply stops, watches what you type, and tells the batch file whether you entered a Y (or a y) or not.

To create GETYES.COM, load DEBUG and type

```
E100 B4 00 CD 16 3C 59 74 04 3C
E109 79 75 02 B0 FF B4 4C CD 21
N GETYES.COM
RCX
12
W
Q
```

Then create two small batch files, CLEAN.BAT and a second batch file called CL.BAT that's called by CLEAN .BAT:

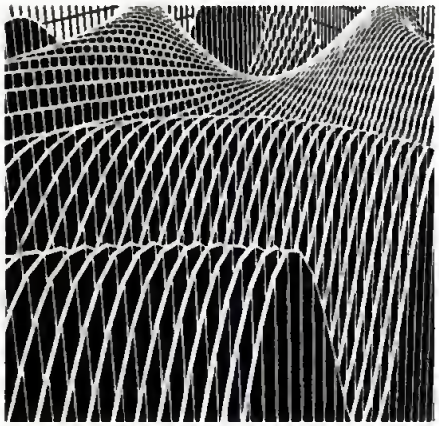
```
@echo off
REM CLEAN.BAT
for %%a in (*.*) do call cl.bat %%a
```

```
@echo off
REM CL.BAT
echo Do you want to delete %1 (Y/N)?
getyes
if errorlevel 255 goto doit
echo %1 NOT deleted
goto end
:doit
del %1
echo %1 deleted
:end
```

The (*.*) tells CLEAN.BAT to look at each file in your current directory. If you want to limit searches to .BAK files, you could change what's in between the parentheses to (*.BAK). Each time CLEAN.BAT finds a file matching the wildcard spec, it uses the CALL command to load CL.BAT and pass the name of the file to it.

2.0 ENABLE

Every now and then in the software industry something momentous comes along and changes attitudes overnight. The introduction of Enable 2.0 (with a LAN version, and now available on 3½" disks) promises to be one of those events.



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Perspective. *The* graphics package. As *Personal Computing* just wrote, "other products cannot even come close."

Now, Perspective is fully bundled in Enable 2.0. Which means you can now have an integrated system beyond all others. Word processing, spreadsheet, DBMS, communications and mind-boggling graphics all in one. All offering the power business users need (for confirmation, just read our "Raves" column to your right).

And what Perspective offers is truly awesome:

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- 180 choices of shades and patterns for various graph elements
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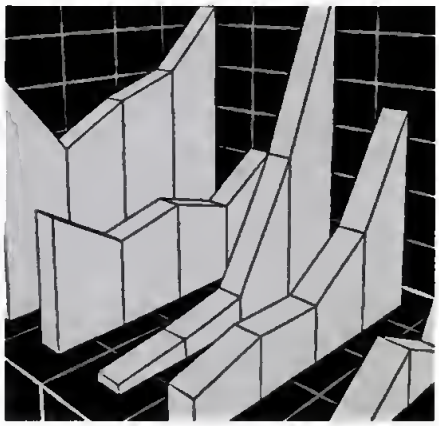
Note: the six remarkable 3-D graphs you see on these two pages were drawn using Perspective. Which should give you greater perspective on Enable 2.0's vast potential.



100+ new features and enhancements to enhance your productivity.

Not bells and whistles, but meaningful improvements! Across all modules. Brought about by listening to our special User Advisory Board, calls and letters to our Customer Support staff and continuing dialogue with such demanding Enable users as the U.S. Air Force, AT&T and Hughes Aircraft.

Here are some 2.0 enhancement highlights:

- A High-Level Language Interface [Basic, C, Pascal]
- Expanded macro facility
- Enhanced report language
- Enhanced menu generator
- Simplified installation/getting started procedure.
- 80,000 word Proximity/Merriam-Webster Linguibase™ spelling checker
- Row/column sorting on spreadsheets
- Simultaneous display and updating of spreadsheet and graph
- Enlarged Import/Export file compatibility with a wide range of popular software*

And remember, these are improvements to what is already recognized as the most fully featured, most powerful, most customizable, tightly integrated software system in existence.

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And thousands of smaller companies have come to the same conclusion: Enable has an incredible ability to handle a nearly unlimited range of jobs.

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- From a DP Manager for Postal Service HQ, "When people come in for a spreadsheet, we give 'em Enable. Database... we give 'em Enable. Word processing... we give 'em Enable. I simply can't see us outgrowing Enable."
- From Xerox, after benchmarking the three leading integrated systems, "[Enable had] the user-friendliness and methodology of integration we were looking for."

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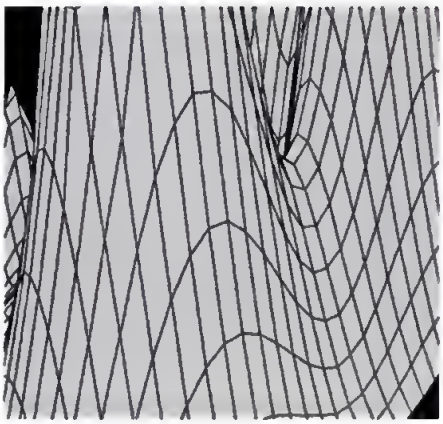
*Compatible with WordStar, MultiMate, EasyWriter, VolksWriter, PeachText, DCA, DIF, ASCII, 1-2-3, VisiCalc, SuperCalc 3, SYLK, dBASE, Condor 3, PC File III.

IN A NEW PERSPECTIVE



One after another, the raves keep flowing in.

Raves! Raves! Raves! Reviewers were lauding Enable even before 2.0.

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(PC Products)

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(Software News)

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(PC Magazine)

"Enable... may be the first program to make you give up your dog-eared WordStar, dBASE, Smartcom and Lotus 1-2-3 disks."

(Business Software)

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- Compatibility with all the major networking software.

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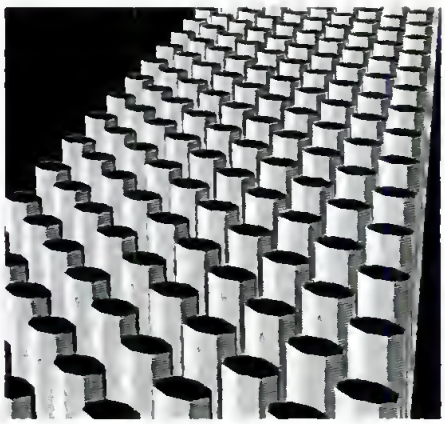
To find out more about all you can do with Enable/LAN, land on your favorite dealer's doorstep.

(Available 2nd quarter, 1987)



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CL.BAT prints a message on-screen, runs GETYES.COM to let the user answer Yes or No (anything other than a Y or y is treated as a No), and branches accordingly when it reaches the IF ERRORLEVEL test. GETYES produces an ERRORLEVEL code of 255 (hex FF) if the user typed a Y or y, and if CL.BAT sees this value, it jumps to the :DOIT label that expunges the file and then exits, returning control back to the original CLEAN.BAT file that called it.

If the ERRORLEVEL value is not 255, CL.BAT jumps directly to the exit and then back to CLEAN.BAT. In either case, CL.BAT prints a message reporting whether or not it deleted the file. It knows the name of each file because the %1 replaceable parameter temporarily holds the value passed to it (in this case the filename) by %%A in CLEAN.BAT's FOR . . . IN . . . DO command.

You can't do file redirection or piping when you use CALL. But you can still use COMMAND /C if you need batch redirection.

DOS 3.3 also documents environment variables for the first time. You can use these to pass information back and forth from application to application or to see what's going on in your environment.

For instance, if you're currently using a customized PROMPT—and every serious hard disk owner should use some variation of $P to see the name of the current logged subdirectory—you can examine the string that did the customization, by typing SET. You can't just type PROMPT, since that resets the custom prompt to the default C> prompt. But SET displays lots of information you probably don't want, such as the COMSPEC, PATH, and perhaps APPEND list. You could filter out all extraneous information with the command

```
SET | FIND "PROMPT"
```

but that would take time, force you to have FIND.EXE handy, and print out something like PROMPT=$p: when you really wanted to display the information faster and in a different form.

Since PROMPT is an environment variable, you could create a tiny batch file called PROMPTER.BAT that displays the actual PROMPT you're using:

```
@echo off
echo Your prompt is currently %PROMPT%
```

The batch file would substitute the current value of the PROMPT environment variable string in place of the %PROMPT% and print a message like

```
Your prompt is currently $P:
```

A primitive way (without writing any files to disk) to see which users have been on your system is with a LOG.BAT batch file. Just add a line that says simply LOG as the last instruction in your AUTOEXEC.BAT file, and create the following LOG.BAT file:

```
@echo off
REM LOG.BAT
if %1!==1 goto oops
if %USERS%!==1 goto first
SET USERS=%USERS%;%1
goto success
:first
SET USERS=%1
goto success
:oops
echo You have to specify your
echo initials after %0, e.g.
echo %0 PS
prompt Enter %0 then your initials$_
goto end
:success
echo Welcome
prompt $P:
:end
```

If the user doesn't enter his or her initials, LOG.BAT jumps to the :OOPS label, which prints an error message and then changes the DOS prompt to provide instructions. The %0 is a special replaceable parameter that prints out the actual name of the batch file that's currently running, so if you change the name to something other than LOG.BAT the batch file will automatically figure it out.

If the user did enter initials, LOG.BAT first checks to see whether any other users have logged in. It can tell by examining the %USERS% environment variable; if there isn't yet any value for %USERS%, LOG.BAT sets the USERS variable to the initials just entered. If LOG.BAT finds initials already there, it sticks the new initials . t the end, after a semicolon. In either successful case, it then resets the prompt so it doesn't print the nasty instructional message, and exits. You could add an additional command at the end, after successful completion, such as 123 or WP, to run a program.

It's obviously easy to avoid this log-in process by using Ctrl-Break or Ctrl-C to crash out of LOG.BAT or the AUTOEXEC.BAT file that loads LOG.BAT, booting off a floppy instead of the hard disk, or just entering junk when asked for initials. Rebooting or running a SET USERS= command would destroy any existing record. And you'd have to be sure you used the CONFIG.SYS SHELL command to increase the environment size so that it accommodates all potential users' initials. But it works. You can walk over later and type SET and see who's been there.

RED, WHITE, AND BIG BLUE DOS 3.0 to 3.2 came in five international flavors. By executing the appropriate KEYB*xx* command, you could tweak the keyboard into British, German, French, Italian, or Spanish modes. Actually, since you could toggle back and forth between the standard keyboard and the foreign variants, you could adapt the KEYB*xx* command to print just about anything on-screen.

For instance, you could patch KEYBUK.COM (the smallest of the five KEYB*xx* files) so that the

```
QWE
ASD
ZXC
```

block of keys would produce either a single-line box (with lowercase letters) or a double-line box (with capital letters). To try this (with DOS 3.2 on an old AT keyboard), type in the following SCRIPT.KBD file:

```
N KEYBUK.COM
L
E 9AB DA C2 BF
E 9B9 C3 C5 B4
E 9C7 CØ C1 D9
E 9E5 C9 CB BB
E 9F3 CC CE B9
E AØ1 C8 CA BC
N KEYBOX.COM
W
Q
```

For other 3.*x* versions of DOS, replace

the address column directly after the initial Es as follows:

```
3.Ø 3.1 3.2
592 662 9AB
5AØ 67Ø 9B9
5AE 67E 9C7
5CC 69C 9E5
5DA 6AA 9F3
5E8 6B8 AØ1
```

Once you've created the appropriate KEYBOX.COM file, run it. You can toggle back and forth between the normal keyboard and the new one by hitting Ctrl-Alt-F1 and Ctrl-Alt-F2.

With Version 3.3, IBM totally revamps the way DOS handles foreign alphabets. But it does so in the most confusing way possible. First, instead of calling the process something clear and simple like "font loading," IBM insists on referring to it as "Code Page Switching." Then, it forces the user to digest three different and seemingly contradictory chunks of the manual—a whole chapter relegated to the rear between Error Messages and EDLIN, an abstruse few pages under DEVICE in the CONFIG.SYS section, and several other dense dollops under MODE, NLSFUNC, GRAFTABL, KEYB, and CHCP. Manual writers everywhere should be forced to plod their way through to see the ultimate example of how not to explain things. *PC Magazine*'s resident DOS expert Charles Petzold took one long look, shook his head, and said, "Thank God we're Americans."

Code Page Switching will show new fonts only with DOS 3.3 and only on EGA/ECD monitors, PS/2 displays, and IBM PC Convertible LCD screens. (You can print the new character fonts only on IBM Model 4201 Proprinters and Model 5202 Quietwriter IIIs.) If you want to see all the new characters, assuming both that the 3.3 DISPLAY.SYS file is in your C:\DOS subdirectory and that you're using an EGA, first include a line in your CONFIG.SYS file:

```
device=c:\doe\display.sys con=(ega,437,5)
```

Then, create a small SHOWFONT .COM file that will display the high-bit ASCII characters DOS tinkers with, by loading DEBUG.COM and typing in

```
E100 B4 0E B0 84 CD 10 FE
E107 C0 3C FC 75 F8 B0 0D
E10E CD 10 B0 0A CD 10 C3
N SHOWFONT.COM
RCX
15
W
Q
```

Finally, type in the following CODEPAGE.BAT batch file (assuming COUNTRY.SYS is in your C:\DOS subdirectory and that MODE, NLSFUNC, and the SHOWFONT.COM file you just created are in a directory you've included in your PATH):

```
@echo off
nlsfunc c:\dos\country.sys
mode con cp prep=((850,863,865) ega.cpi)
echo Hit any key 4 times
mode con cp sel=865 >nul
showfont
pause>nul
mode con cp sel=850 >nul
pause>nul
mode con cp sel=863 >nul
pause>nul
mode con cp sel=437 >nul
```

While Code Pages 865, 863, and 860 will be interesting only to residents of Norway, French-speaking Canada, and Portugal, Multilingual CP 850 replaced some of the standard Greek and block graphics characters with things like ®, ©, ¶, ×, ¢, ¾, and ¹ and ³.

The CHCP command lets you select code pages on a systemwide level (MODE does it at the device level)—and when used without any arguments will report the current code page. GRAFTABL can now load in the new high-bit characters and will also report the current code page. KEYB handles the new keyboard headaches.

IBM prefaces its long appendixlike treatment of the topic with the caveat "You can use code page switching without fully understanding everything about it." After poring over the text, you'll know why this was included.

GOODBYE OLD FRIEND The bad news is that IBM removed all references to DEBUG in the normal DOS manual (even though it's still on the disk) and did away with LINK, EXE2BIN, and VDISK.SYS, which now come with the $85 DOS *Technical Reference* manual only. Serious programmers will want the DOS *Tech Ref* anyway, and LINK often comes packed with compilers these days, but it was a genuine crime to toss the documentation on DEBUG. (And the manual doesn't even mention a single advantage of using ANSI.SYS, also detailed solely in the *Tech Ref*.) Shame on IBM.

With 3.3, IBM defines four new INT 21 functions—Get/Set Extended Country Information (65H), Get/Set Global Code Page (66H), Set Handle Count (67H) (which pushes DOS past the former 20-file-per-process limit and can open up to 255 files at once), and Com-

Comparative Sizes of IBM DOS Versions

DOS Version	COMMAND.COM (bytes)	IBMBIO.COM (bytes)	IBMDOS.COM (bytes)	Total bytes used by system files
DOS 1.0	3,231	1,920	6,400	13,312
DOS 1.1	4,959	1,920	6,400	14,336
DOS 2.0	17,664	4,608	17,152	40,960
DOS 2.1	17,792	4,736	17,024	40,960
DOS 3.0	22,042	8,964	27,920	60,416
DOS 3.1	23,210	9,564	27,760	62,464
DOS 3.2	23,791	16,369	28,477	69,632
DOS 3.3	25,307	22,100	30,159	78,848

This table shows the comparative sizes of all IBM DOS versions. (You can use this chart to look at the size of COMMAND.COM on diskettes formatted with the /S option and determine the DOS version number.) DOS 3.3 is a whopping six times larger than 1.1 and is 13 percent faster than its immediate predecessor

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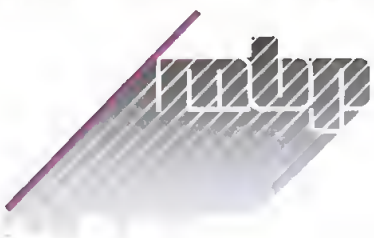

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CIRCLE 223 ON READER SERVICE CARD

■ DOS 3.3

mit File (68H) (which "commits" modified file data to disk and updates the directory entry but doesn't close the file).

OK, so DOS is far from perfect. Utilities like TREE and COMP are a disgrace, and too many explanations are opaque. MODE still utterly ignores EGA video enhancements, and the EGA has been superseded by the next-generation PS/2 graphics! The already irksome "Abort, Retry, Ignore?" is now an even more chilling "Abort, Retry, Fail?"—

The already irksome "Abort, Retry, Ignore?" is now an even more chilling "Abort, Retry, Fail?"

■ ■ ■ ■ ■

not much of a choice and about the farthest thing from friendly. At $120 a crack ($75 for an upgrade), it's not cheap.

But there are genuine signs of improvement. DOS 3.3 sniffs out the hardware configuration and sets from 2 to 15 buffers automatically instead of simply assuming every PC and XT user really wanted only 2 and every AT user only 3. Warnings are bolder and a little clearer; the manual properly explains for the first time that the command DEL *filename*.? will eradicate both files with single-character extensions as well as files with no extensions at all. The space-wasting BASIC.COM is gone forever (the BASIC command simply loads BASICA). And enhancements like the CMOS clock-setting DATE and TIME, muted ECHO OFF, 19,200 bit-per-second COM1–COM4, slicker and safer BACKUP and RESTORE, and long-awaited APPEND make it a winner. Still, IBM and Microsoft have a long way to go in adding the kind of power, ease, and flexibility sophisticated users are demanding. PC

Paul Somerson is an executive editor at PC Magazine.

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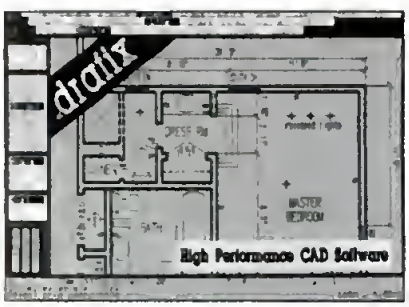

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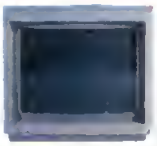

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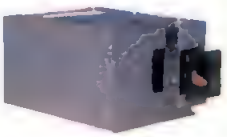

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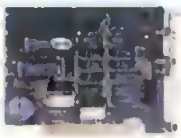

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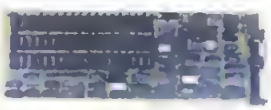

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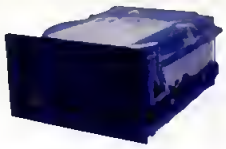

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CIRCLE 210 ON READER SERVICE CARD

ROAD WARRIORS: 11 LAPTOPS BATTLE IT OUT

Every day, more and more laptop PCs take to the roads, the skies, and even to some desktops. From the tiny 9-pound PCs to 20-pound AT-class marvels, there's a portable for every budget.

Taking DOS on the road in 1982 meant lugging a 31-pound Compaq Portable through airports. Now you have your choice of a half-dozen 10- to 15-pound laptops you can perch on your knees without being tethered to an AC line; a 15-pound AT-compatible hardly bigger than a loose-leaf notebook; battery- and AC-powered PC-, XT-, and AT-compatible lunchbox-looking affairs; and other variations.

By some estimates, one of every ten PCs sold in the next year will be a laptop, which takes DOS-to-travel from an oddity for reporters and status-conscious executives to an everyday tool. Attach an external monitor and they make passable desktop PCs, albeit with somewhat cramped keyboards and CGA-level resolution. So far, none can drive a monitor at EGA (640 by 350 pixel) resolution.

TARIFF BARRIER The laptop market could falter if the Reagan administration's 100 percent tariff, announced April 17, remains in effect for long. In retaliation for alleged unfair chip pricing by the Japanese, the White House tacked tariffs on made-in-Japan power hand tools, 18- to

20-inch color TV sets, and full 16-bit LCD laptops and desktop computers.

The 100 percent tariff is on the imported value of the machine, which is roughly half the list price. So a $1,995 laptop becomes a $2,995 laptop. Toshiba and NEC are obviously hurt; IBM with its made-in-America PC Convertible is obviously safe. But many of the U.S. companies, such as GRiD and Wang, get their laptops from Japan. The tariff announcement was unclear as to whether 8088-based laptops would be affected, since the 8088 has an 8-bit data bus externally and 16 bits internally.

Since *PC Magazine* last looked at the laptop breed 7 months back in "DOS Travels Better Now" (Volume 5 Number 22), more vendors have joined the fray, most visibly NEC, and the supertwist LCD screen has supplanted the LCD with a slightly more legible display. (Supertwist refers to the angle between the planes of LCD crystals. Supertwist screens have 270-degree angles; earlier LCDs had 90. The greater the angle, the more legible the screen.)

The 3½-inch drive is the storage medium of choice for laptop portables, despite continued hassles getting data back and forth from 5¼-inch desktop machines. IBM's PS/2 announcement portends a brighter future for the smaller disks.

While more backlit screens are available (NEC is the latest convert), the technological breakthrough in batteries that would boost their operating times past the current 2 to 4 hours remains beyond the horizon. But how much does it *really* matter? While the Walter Mittys among us envision that sleek GRiD helping calculate the bottom line on a hostile takeover target as we whoosh to the Coast in a Gulfstream at 48,000 feet, most users are tapping out sales reports 6 feet from an AC outlet in a Holiday Inn.

The laptop class has more than a half-dozen niches, based on size, weight, power source (AC or battery), battery life, type of display, drive type (3½- or 5¼-inch floppy or hard disk) and capacity, and computing power. From small to large, cheap to expensive, and in generally increasing order of power, the categories are roughly:

■ Compact non-DOS laptop notetakers such as the Tandy 100, 102, and 200 or the NEC 8401 and 8501, priced at $300 to $1,000, with nonilluminated LCD screens, 300-bit-per-second modems, and long battery life. ASCII files can be transferred easily to a PC once you get the hang of it. An aging class of machines that could be revitalized and downsized with the current generation of chips.

■ Bizarre almost-MS-DOS laptops: the Tandy 600 (single drive, not fully DOS compatible) and the HP Portable (no disk storage). Mere sideshow curiosities or, as *PC Magazine* executive editor Paul Somerson said in his one-word review of the HP 6 months ago, "Landfill."

■ Foot-square, 10- to 15-pound MS-DOS clamshell-design laptop portables, typically with low-power-drain CMOS (complementary metal oxide semiconductor) 80C88/80C86 processors, a pair of 3½-inch 720K drives, flip-up 80- by 25-line LCD screens, 640K bytes of RAM, room for a 1,200-bps modem, parallel and serial jacks, an output for an external monitor, and a $2,000 list price. This is the most hotly contested category. Players include the Toshiba T1100 Plus, the NEC MultiSpeed, the IBM PC Convertible, the new GRiDLite, the Datavue Spark, the Data General One/Model 2T, and the Kaypros. So far, all use 720K drives. Toshiba and NEC are the market leaders.

■ Backlit LCD variations of same, about $300 to $500 more expensive than comparable nonbacklit systems, and easier to read for the 2 to 4 hours their batteries last. So far, only the new DG One/Model 2T is readable with the backlighting off. (The backlighting panel behind the LCD panel takes the place of a reflective panel on nonilluminated laptops.) Zenith's Z-181 owns the category right now, and its new 183 only strengthens its position. Competitors (a few with plasma screens): NEC with a backlit variation of the MultiSpeed, Wang, GRiD, and Data General. Zenith is the clear market leader; NEC will be joining the category as it upgrades the MultiSpeed to backlighting.

According to Zenith, a backlit LCD screen has a contrast ratio of about 7:1, 12:1 with a supertwist LCD. That compares to about 3:1 for a standard LCD, and 15:1 to 20:1 for a standard CRT display.

■ Hard disk 8088/8086 variations on the T1100/Z-181 theme, generally with backlit screens, but still battery-powered. The GRiDCase 3 Plus, the DG One/Model 2, the Wang LapTop, plus a handful of third-party vendors who'll cobble a hard drive onto an existing Toshiba T1100. Zenith's new Z-183 should be the top seller in this category.

■ Lunchbox-size PC- and XT-level machines, with 5¼-inch drives, generally with illuminated screens, and weighing 15 to 20 pounds. Some have internal batteries, others are AC only. Most allow a hard disk to be one of the drives. The heyday of this category was in early 1986 when Zenith won the IRS contract with its Z-171. Others include Quadram's Datavue, the now-deceased Morrow Pivot, the AC-only Sharp PC-7000A, and the Panasonic Executive Partner (with built-in printer).

■ AT-class, AC-only $4,000 machines with gas plasma screens and hard disks: the Toshiba T3100 (clamshell design) and Compaq Portable III (lunchbox).

■ The luggables or "transportables," those CRT-based 25- to 30-pound units the size of portable sewing machines. Compaq pioneered this now-shrinking field and Compaq owns it, having killed off most of the competition and all but two of its own: the original 8088-based Compaq Portable and the downsized 80286-based Portable II. Biggest advantage of these two is that they accept the expansion boards used on desktop PCs, for instance, if you want to string together a mininetwork on the road.

OUR REVIEWERS

Nora Georgas is an associate editor of *PC Magazine*.
Bill Howard is an executive editor of *PC Magazine*.
Mitt Jones is an assistant editor of *PC Magazine*.
Bill Machrone is editor of *PC Magazine*.
Greg Pastrick is an assistant managing editor of *PC Magazine*.
Paul Somerson is an executive editor of *PC Magazine*.
Paul Stafford is assistant business manager at Ziff-Davis Publishing Co.
Gus Venditto is senior editor of *PC Magazine*.

The Perfect Portable

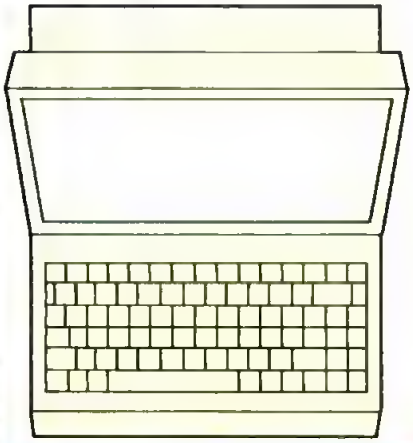
Everyone has a diffarent idea of tha idaal portabla laptop or luggable portabla computar—otharwise, you wouldn't see weights from 3 to 30 pounds and prices from $400 to $4,000.

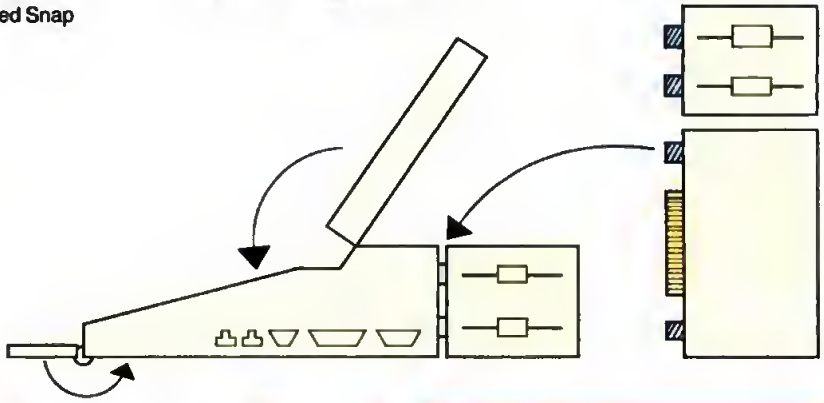
Makars of current portables assume you have the sama needs every day and make you choose between low weight/small footprint and added featuras/mora bulk. But what you need as a memo-writing commuter isn't what you need on an extended business trip working up spraadsheets.

Hare's a highly personal view of the ideal portable. Based on modular construction, it combines the best faatures of a half-dozen machines. Quadram's yet-to-be-ralaased Snap comes close, but the prototypes weren't awe-inspiring in their ruggedness.

Tha base machina should weigh under 5 pounds—an MS-DOS variation of the Tandy 100/200. Clip-on modules let you add disk storage, an illuminated display, more battery power, and even a hard disk.

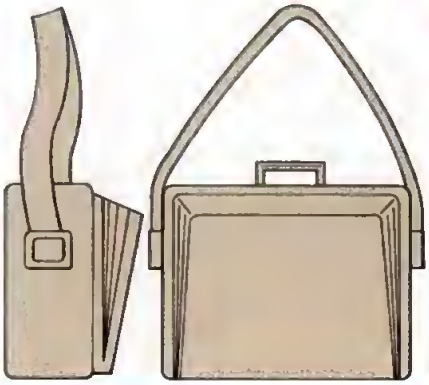
Price? You should pay $1,250 for the base unit with a 1,200-bit-per-second modam, $350 for tha backlit screen, another $750 for the dual-floppy-drive clip-on module, and $1,000 for the floppy/Winchester version.—**Bill Howard**





BASE UNIT

- $1,250
- 12 by 8 by 2¼ inches
- 4.5 pounds
- Handle on underside
- 81-key keyboard with inverted-T cursor layout, individual page-movement keys (PgUp, PgDn, Home, End).
- 80C86 processor, 4.77/9.54 MHz
- 80286 processor optional
- 1-Mbyte nonvolatile RAM, switchable in 128K segments (to save battery life).
- Four penlight batteries good for 10 to 15 hours
- Nickel cadmium battery backup for RAM while changing batteries.
- I/O along the side: 1,200-bps Hayes-compatible modem, parallel and serial ports, EGA/VGA (IBM's new 640 by 480) external video output. Back is preferable, but it's taken by the expansion module.
- Programs in ROM: MS-DOS, *1-2-3* or *Excel*, barebones version of *Microsoft Word*, *WordStar*, *WordPerfect*, or *XyWrite*; *SideKick* or *Metro*; communications. $50 burn-in fee per module to existing users.



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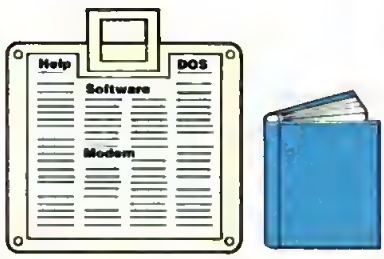
- Space for additional 1 Mbyte RAM
- Quick-change nickel cadmium battery runs LCD/floppy disk unit 6 to 8 hours.
- $750 ($1,000 for hard disk unit)



DISPLAY

- Removable supertwist screen
- 80 by 25 LCD
- 10 by 7½ viewing area
- 4:3 aspect ratio (same as PC)
- Alternate 60 by 16, 40 by 12 modes for bigger characters in low-light situations. Built-in programs will support alternate display modes.
- 4:1 contrast ratio
- $350 optional backlit supertwist LCD, 12:1 contrast ratio. Requires AC power or rechargeable battery in expansion unit.

MANUAL

- 24-page command summary
- Plastic-coated stock
- Basics also printed on underside of machine and in ROM.

DISK DRIVES With its Personal System/2 desktop computers, IBM declared the future of floppy disks to be 3½ inches. And with 1.4 megabytes of capacity per drive, a hard disk may not be a necessity in your laptop. It's only a matter of time before the 1.4 drives show up on laptops. Imagine a second-generation PC Convertible based on the PS/2 Model 50 motherboard with a pair of 1.4s.

The 1.4-megabyte drives read 720K-byte disks and should be able to write to them as well, unlike most 1.2-megabyte 5¼-inch drives that never wrote successfully to 360K-byte floppy disks.

During the transition from 5¼ to 3½ inches, you'll have multiple data-transfer choices. In "The Technology of Transfer," contributor Howard Marks reviews the laptop-to-desktop transfer options. Most laptop makers offer external 5¼-inch drives, or you can add a 3½-inch drive to your PC. Some have "floppy links," Toshiba's term for a cable-and-expansion-card arrangement that lets the laptop control the 5¼-inch drive in your desktop PC. And there's a growing field of "bridge" programs that trick your 9,600-bps serial ports into running at 115,200 bps and let you transfer data at near-floppy-disk speeds. IBM even joined in with a $33, one-way Data Migration Facility that moves information from your old 5¼-inch-drive PC to the new microfloppy PS/2 line via the parallel port.

On the following pages, *PC Magazine*'s editors rate the latest laptops. We reviewed every new or substantially upgraded machine since the last report, and brought back the two Editor's Choices, the T1100 Plus and the Z-181 (actually, the next-generation Z-183), to see if they're still the best.

A features table and PC Labs benchmark test charts detail some of the less-obvious differences between the units: how fast the processors run, how much they weigh in fighting trim with charger and internal modem, overall size, screen size and ratio (most are flatter than the 4:3 ratio of desktop CRTs), what comes standard and what costs extra, and which ones have removable battery packs, ROM sockets for custom programs, or nonvolatile memory that lets you flick off the power without saving your files.—**Bill Howard**

BONDWELL INDUSTRIAL CO. INC.

Bondwell 8

My mother always told me if I couldn't say something nice about something, I shouldn't say anything at all. If I followed her advice, this would be a very brief review.

I suppose there are a couple of nice things to be said for Bondwell Industrial Co. Inc.'s Bondwell 8. At 10 pounds, its only real competitors in the non-thigh-crusher contest are the 9.7-pound GRiD-Lite and the 9.9-pound Toshiba 1100 Plus. And the Bondwell's 12-inch by 11½-inch by 3-inch dimensions make it the most compact of any of the machines reviewed here. It's cheap—$1,295 includes the backlit LCD screen, 512K bytes of RAM, single 3½-inch floppy disk drive, built-in modem, DOS 2.11, GW-BASIC, and communications software.

Now for the bad news: The screen is a half-height deal with tiny characters, the modem is only 300 bits per second and it isn't Hayes compatible, and 512K is the maximum RAM this machine can accommodate.

The 80C88 processor turned in one of the most sluggish performances on our benchmark tests.

The keyboard is extremely cramped, with almost vestigial function keys and a tiny Esc key along the top, and a weird arrangement of four triangular cursor movement keys in the upper-right-hand corner. Most of the other keys are where you'd expect to find them, but because the Bondwell is so small, the keys are very tightly packed, and the Spacebar is much smaller than usual even on laptops.

A small flip-down panel on the rear of

COUNTERPOINTS

The Bondwell 8's tiny display isn't that bad up close, but I couldn't live with the keyboard feel.—**Mitt Jones**

The major surprise here is that this doggie, with its abbreviated keyboard, washed out screen, and nonstandard modem, is still in the window.
—**Paul Stafford**

More landfill.—**Bill Howard**

The Bondwell 8 is the most compact of the machines reviewed here, but the screen and the keyboard suffer as a result. The screen does feature backlighting, and it is almost a requirement due to the poor legibility of the unlit LCD.

Photographs: Roberto Brosan

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(415) 490-4300
List Price: With one 3½-inch disk drive, 512K RAM, 300-bps modem, $1,295; external 3½-inch floppy disk drive, $399.95; external 5¼-inch floppy disk drive, $379.95; carrying case, $39.95; printer cable, $29.95; serial cable, $29.95.
In Short: A compact but uninspiring machine with limited features and poor keyboard. Keep looking.

CIRCLE 673 ON READER SERVICE CARD

the machine conceals serial and parallel ports, plus an interface for an external disk drive. The panel is hinged, so you can't lose it. Nice touch, but for some reason the little panel covering the RGB and video interfaces, which are inexplicably located on the side of the machine instead of along the back with the other ports, is not attached. It's also difficult to snap back in place.

The two jacks themselves are handy, but the labels "telco" and "telset" remain a complete mystery. They're never mentioned in the documentation, which devotes almost 70 pages to the communications function alone and also features some incredibly detailed full-page flowcharts, such as the "Line Connection Mode Operation Chart," which is only slightly more complicated than a London Underground map.

Battery life is rated at 6 hours, and lasted 5.8 hours in our access-intensive testing.

An unkind colleague said reading the Bondwell's screen is like "looking through a Jello salad." I wouldn't go quite that far—the display is small, but it's pretty legible. There's a switch to turn off the backlighting, presumably to save power, but there's not much point since you can't see the screen without the backlighting.

This isn't even the cheapest laptop on the market. Datavue's Spark, which lists at $995, gives you a better screen and keyboard, more memory, and more options. That the more expensive machines in this roundup are superior to the Bondwell goes without saying.

Reviewing a less-than-inspiring product is a sad task, especially since the Bondwell is an oddly compelling little machine. Maybe it's the perfect nerd laptop, with its weird comm program and squinty screen, but I just can't recommend it when there are so many better laptops around. Sorry, Mom.
—Nora Georgas

COMPAQ COMPUTER CORP.

Compaq Portable III

Compaq took a good idea—the lunchbox computer—and made it one of the best-performing machines on the market, whether it has a handle or not. Compaq Computer Corp.'s Portable III distinguishes itself with an 80286 processor, 12-MHz clock speed, and a hard disk you'd be proud to have on your desktop machine. In fact, the Portable III beats the typical PC AT in every performance test. The only area where it takes a back seat to conventional machines is in expansion slots: except for two proprietary slots, it doesn't have any.

Lack of slots isn't really a problem for most users. You can put up to 6.6 megabytes of RAM into the machine in one proprietary slot using compact, single-inline memory modules (SIMMs). Likewise, it accepts a 1,200-bit-per-second Hayes-compatible modem in another proprietary slot. And, of course, it has a serial port, a parallel port, and a CGA-compatible RGB monitor port. That about covers most needs.

■ Compaq took the lunchbox computer and made it one of the best-performing machines on the market.

I'd like to see a bus mouse jack and EGA color support instead of CGA, but

The Compaq Portable III is smaller yet more powerful than its ancestors. The brilliant gas plasma display is of desktop quality, and it pivots to a wide variety of viewing angles. An 80286 processor and hard disk make this lunchbox machine a true AT-class portable.

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Digital Communications Associates, Inc./1000 Holcomb Woods Parkway
Roswell, Georgia 30076/1(800)241-6393

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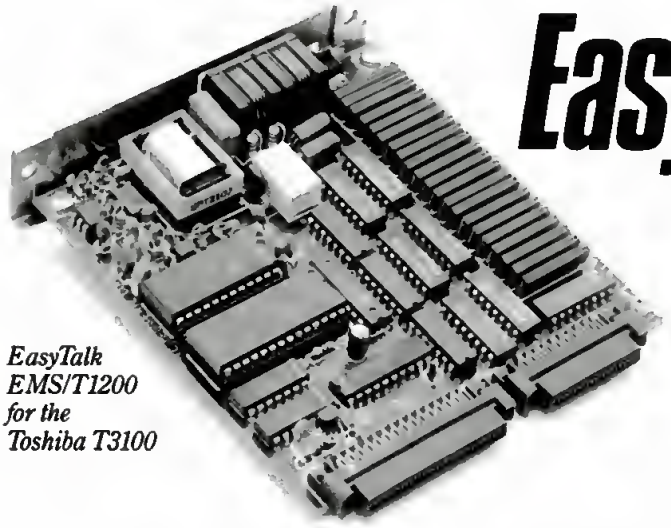

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1-800-338-8726

*Prices from Toshiba Price List as of April 1, 1987

Also compatible with the GRID 286. Trademarks and their owners: Toshiba, T3100—Toshiba America Inc. EasyTalk—Megahertz Corporation. Crosstalk—DCA. Lotus—Lotus Development Corporation. Intel—Intel Corporation. Microsoft—Microsoft Corporation. GRID—Grid Systems.

CIRCLE 344 ON READER SERVICE CARD

that's a quibble. Once you have an internal modem, you can use the serial port for a mouse. And if that's still not enough, you can add the optional expansion chassis, which takes two full-size PC AT expansion boards. Thanks to intelligent design, the expansion module clips and unclips positively and reliably. So it's perfectly natural to have, say, a network card and a high-resolution graphics card in there for office work, and simply leave the expansion module behind when you hit the road.

The Portable III's most notable feature is its gas plasma display. The bright orange screen measures 5.5 inches by 8.5 inches, roughly equivalent to a 12-inch CRT monitor. Its 640- by 400-pixel resolution produces crisp, clear characters. The display is as readable as a CRT in any lighting conditions, and has a far wider viewing angle than the LCDs found on most portables. It's comfortable for long viewing periods.

My only reservation about the screen is its ability to translate colors into brightness levels. Our standard colorbar test came out as a screenful of orange with a light rectangle and a dark rectangle. Programs perform best on the Portable III when they're installed for monochrome.

In use, the Portable III is exactly what you'd expect: it weighs the most, and it does the most. You also pay top dollar for top performance. In Compaq's newly abbreviated lineup, it takes the lead as the top-performing portable computer from the venerable, heavy (and retired) Portable 286.

At 20 pounds, the Portable III is the heaviest machine we tested, but it's well balanced and packs away easily under an airplane seat or in the overhead compartment. It isn't my first choice for everyday travel—that honor belongs to battery-powered machines—but when you need the power, there's no substitute.

Compaq is rightly famous for its IBM compatibility. Indeed, it has been far more conscientious than IBM in preserving the "PC standard." The Portable III is no exception to this attitude. The expansion slot ran every board we tried in it, including network cards, modems, memory boards, and a 3270 adapter. The machine automatically slows to 8 MHz when you start programs from the floppy disk, so as not to be tripped up by archaic copy-protection schemes. You can speed it up again from the keyboard.

The keyboard has only ten function keys. This might become a drawback, because although there isn't yet any commercial software that uses the F11 and F12 keys found on IBM's enhanced keyboard, there likely will be, since the enhanced keyboard is now IBM's only keyboard. Some revile Compaq keyboards for being light or mushy. But you can type quickly and accurately.

Likewise, I've heard others disparage the Portable III's looks. The pop-up screen and squarish configuration strike them as unlovely, to which I can only say, Who cares? Form follows function. The beauty of this machine is on the inside and is embodied in its fitness for purpose. It's still very much a 5¼-inch world out there. Most users don't want to be bothered with the hassles of disk format conversion, serial cables, and the like, especially when they're on the road. The Portable III isn't for everybody. But if speed is what you need and you do your computing within 10 feet of an electrical outlet, there's no better choice.
—Bill Machrone

FACT FILE

Compaq Portable III
Compaq Computer Corp.
20555 FM 149
Houston, TX 77070
(800) 231-0900
(713) 370-0670
List Price: Model 1, with two high-density (1.2-Mbyte) 5¼-inch floppy disk drives, $3,999; Model 20, with 20-Mbyte hard disk and one high-density floppy disk drive, $4,999; Model 40, with 40-Mbyte hard disk and one high-density floppy disk drive, $5,799; 1,200-bps modem, $399; DOS 3.2, $95.
In Short: For sheer power on the road, nothing will top the Portable III. If you work within easy reach of an AC outlet (which it requires), there's no better choice.
CIRCLE 672 ON READER SERVICE CARD

COUNTERPOINTS

The Compaq Portable III makes it possible for workaholics to take a vacation.—**Gus Venditto**

$4,999? Twelve-MHz speed has its price, and I'm not buying. Buy a Spark and an IBM PS/2 Model 50 for the same price.—**Mitt Jones**

If you can have only one PC for the office and out in the field, the Portable III may be the best combination for well-heeled power users. Be sure to pop for the expansion box, an EGA card, and a MultiSync monitor for the office, because plasma displays aren't quite there yet.—**Bill Howard**

The first question is whether you can make up the time you'll waste schlepping this Godzilla by being able to run your programs a little faster. The second is, who can be bothered any longer with the Portable II?—**Paul Stafford**

DATA GENERAL CORP.

Data General One/Model 2T

I was beginning to get tired of the old Data General One. Its screen was so dim it inspired one of the industry's most beloved jokes ("Is it on?"); its keyboard was best suited to midgets, and everyone and his cousin was offering a better feature mix for a lower price.

Then, last year the minicomputer giant rumbled to life and gave birth to a minor miracle: Data General Corp.'s Data General One/Model 2. The DG One/2 was most noticeable for having the longest name in laptops. It was basically the same old machine, but you could choose between a readable LCD and battery operation or a very readable electroluminescent display and AC-current compatibility, and a price that at least had not gone up.

Neither of these poor machines prepared me in the slightest for the metal DG is now peddling. The Data General One/Model 2T is remarkable—not in comparison to its competition, but in

A 10-megabyte hard disk option is one of the new features of the updated Data General One/Model 2T. The backlit screen is at least tall, if not particularly vibrant. At $2,895 with hard disk, the DG One is price competitive with other hard disk laptops, though not as speedy.

comparison to its own past versions. It is a revolutionary catch-up effort for a company that had fallen behind and seemed committed to staying there. Finally, a modern laptop out of Data General!

Check out these features: a 7.16-MHz 80C88 microprocessor, 512K bytes of RAM standard expandable to 2 megabytes, parallel port and choice of RS-232 and RS-422 serial ports, backlit LCD, removable battery, one standard 3½-inch 720K-byte floppy and one optional floppy or 10-megabyte hard disk, numeric keypad, and two tiny I/O slots for adding external graphics output, extra ports, external floppies, or whatever else DG comes up with. Except for a built-in modem (DG's is 1,200 bps, includes a handy acoustic coupler, and costs $400) and built-in RGB output, it's safe to say the Model 2T is now at least a contender in the features race that rages in the laptop market. The prices are even reasonable: the basic unit goes for $1,895, rising to $2,895 for a hard disk model.

Some of the Model 2T's technology is pretty outrageous, too. In the quest to curb battery thirst, Data General has put a lot of hardware features under software control. Mode commands can shut down either port, the RGB card, or the hard disk. The display's backlighting has four keyboard-selectable brightnesses, each a little more readable, but each a little more power-thirsty. The battery recharges in about 12 hours (you can use the machine while it's recharging), and drains in about 5 (depending on backlighting and other demands). You can also buy a "quick charger" that will recharge fully in 2 hours. As the power gets low, a warning message pops on-screen, using the 25th line that PC software not adapted specifically for the DG One can't use.

The hard disk is a techno-wonder—a plated-media JVC whose head automatically parks after 5 seconds of inactivity. At 150-milliseconds average access time, it's no Speedy Gonzales, but it takes a Ricochet Rabbit–like pounding without a head crash, even while powered up. Also useful is the two-slot internal expansion bus (three, since there's a separate slot for pop-in RAM).

A laptop is only as good as its display, and the 2T's is really not bad. Backlit at full strength, readability is good in all light, though it doesn't compare to the wonders sported by the Zenith Z-183 and AC-powered Toshiba T3100. Readability suffers at lower levels of luminescence but still remains tolerable. Unlit, it's better than the Zenith in the same state, but you need pretty good light to get any work done. Contrast and reflectivity are decent, but not quite as good as that of

COUNTERPOINTS

Yes, I'm the guy who said the last time we reviewed a DG One that I'd start using a smaller keyboard when my fingers got smaller. But the screen is magnificent, and it makes me forgive an awful lot. Actually, if it's the only keyboard you ever use, you'll adjust with no problem. If you switch back and forth between your office and road machines, you're more likely to hit incorrect keys on both of them until you accommodate. The Model 2 is a laptop to be reckoned with.—**Bill Machrone**

Data General improves the DG One by a substantial amount every year. It still doesn't come up to par with its competitors.—**Gus Venditto**

PC MAGAZINE FACT FILE

Data General One/Model 2T
Data General Corp.
4400 Computer Dr.
Westboro, MA 01581
(617) 366-8911
List Price: With 512K RAM and one 3½-inch floppy disk drive, $1,695; with 512K RAM and two floppy disk drives, $1,895; with 512K RAM, one floppy disk drive, 10-Mbyte hard disk drive, $2,895; external 5¼-inch floppy disk drive, $795; quick charger, $95; 300/1,200-bps modem $400; memory expansion cards: 256K, $200, 1 Mbyte, $495, 2 Mbytes, $895.
In Short: At last, a competitive laptop from Data General. Its keyboard still has problems, but the price is reasonable and the list of features long.

CIRCLE **671** ON READER SERVICE CARD

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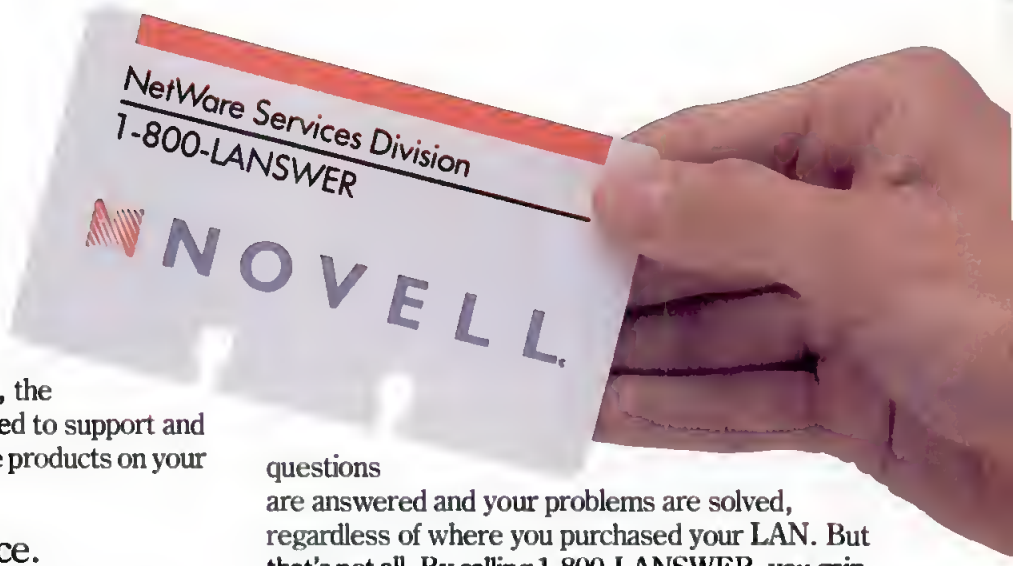

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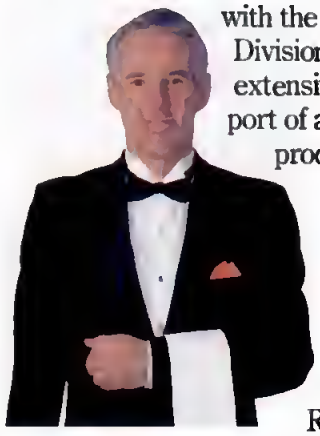

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CIRCLE 155 ON READER SERVICE CARD

the Toshiba T1100 Plus. This is not the best laptop screen available, but it offers more options for different light conditions and battery levels than any of the others do. If we were handing out an award for the most-improved display, the 2T would win by a mile.

Too bad I can't say the same for the keyboard. It still stinks. I suppose you can get used to anything, but in this case I'd rather not. The layout is the usual compromise: embedded numeric keypad, "Spcl" key for getting the Home, End, PgUp, and Pgdn functions on the arrow keys to work, and miniature function keys. What's really objectionable about the 2T's keyboard, though, is that it has too many keys. Or is it too little space? You get the idea. The keytops are both too small and too close together, resulting in more annoying typos than you want to know about. And while I prefer a noisy IBM-type keyboard in a desktop computer, DG's clicking keys will make boors out of users so inconsiderate as to type on them in public spaces (unemployed boors if they try taking notes in meetings with the boss).

■ If we were handing out an award for the most-improved display, the DG One would win by a mile.

I admit I'm automatically prejudiced against anything bigger and heavier than the Tandy Model 100. The 2T is in the same gargantuan class as its competition, and that's too big for anyone who likes to travel light. DG's $99 carrying case is only an option in the sense that you have to pay extra for it; attempt to lug this monster by the handle only if you're not satisfied with the length of your arms.

The features are abundant. The price is acceptable. The screen is readable. DOS 3.2 and a 1-year warranty are included. After years of lying around getting kicked by the competition, DG has finally proven it can solder up some pretty good technology when it puts its mind to it. Despite its weight and its (expletive-deleted) keyboard, the Data General One/Model 2T at the very least shows that Data General's heart is in the right place.—**Paul Stafford**

DATAVUE CORP.

Datavue Spark

Marketing people are an interesting breed. They are, for the most part, a creative bunch of people who spend an awful lot of time devising schemes and strategies to make a product enticing and salable to a specific class of consumer. Take Datavue Corp.'s Datavue Spark, for example. Its name gives away the marketer's intentions. "Spark" is a spunky moniker aimed at grabbing the "go ahead" business and consumer users. And it's a perky little machine—sort of the Mary Hart of IBM-compatible portables.

Although Datavue considers the Spark an entry-level machine designed for the first-time laptop user, its 80C88 microprocessor has a peppy selectable 9.54-MHz processor speed (4.77 MHz on the low end), matched only by the NEC MultiSpeed. And with its $995 base price, it's $300 cheaper than its closest price competitor—the slovenly Bondwell 8.

Cased in dusky gray plastic, the Spark is an unobtrusive machine comparable in

FACT FILE

Datavue Spark
Datavue Corp.
One Meca Way
Norcross, GA 30093-2919
(404) 564-5668
List Price: With supertwist LCD screen, 3½-inch 720K-byte disk drive, 384K RAM, 4.77- and 9.54-MHz speeds, DOS 2.11, $995. Options include electroluminescent backlit screen, $125; 3½-inch disk drive, $200; internal 300/1,200-bps modem, $325; external 5¼-inch disk drive, $210; 256K memory board, $130; carrying case, $75.
In Short: An under-$1,000 laptop competitive with the NEC MultiSpeed and Toshiba T1100 Plus in performance and features, but really beats the bunch on price.
CIRCLE 670 ON READER SERVICE CARD

Priced at $995 with one disk drive, the Datavue Spark is setting a new standard for the low end of the laptop market. Its 80C88 processor has a 9.54-MHz clock speed, comparable to the NEC MultiSpeed. The Spark's display is weak, but an electroluminescent option is available.

weight and size (though it's an inch longer) to the Toshiba T1100 Plus. Its flip-up screen locks down at the front and has excellent range of motion. You can lay it back flat against the case, pull it up straight, or angle it anywhere in between. The drives are housed on either side and to the rear of the machine, with the monitor, serial, and parallel ports laid out along the back end. A screen brightness adjustment wheel is set on the right below the keyboard and in front of the power switch. The AC adapter plugs in at the rear. All in all, the Spark is a clean-cut laptop in its style and design.

But the Spark's not just an empty suit. Along with the 16-bit 80C88, there's a CMOS version of the 8087 coprocessor installed as standard equipment. The review model had a healthy setup: two 720K-byte 3½-inch drives, 640K bytes of RAM, and a supertwisted LCD. The weakest link in this lineup is the display, which was fine under bright office lighting but a real eyestrainer in less-than-optimal conditions. Fortunately, Datavue has an electrolumiscent backlit screen option available for $125. For an even brighter view of laptop work, the Spark has RGB (controlled by a 16-color V6355 chip) and monochrome ports with standard connectors.

The 77-key keyboard has a solid, professional feel on a par with the NEC MultiSpeed, the Toshiba T1100 Plus, and the Zenith Z-183 Portable PC. The layout of the keys is easily readable and reachable. You don't have to get into any finger gymnastics to get to all the important keys. Ten programmable function keys stretch across the top. A numeric pad, toggled with a left-hand function key or NumLock, is built into the letter keys. Directional cursor keys are separated from the key layout to the lower right of the board.

Custom system configurations can be accessed either at power-on or, for at-work selections, through Ctrl–Left Shift key combinations. The primary configuration at initial power-on steps you through the default setup. Then, hitting Ctrl-R lets you reconfigure for other drives, clock speeds, monitor hookup, and port activation. There are some other key-selectable options that can be changed anytime while you're working. For example, to swing through and choose one of the five LCD palettes, you toggle the screen you want with the Ctrl-Shift-S key combination. One simple and often overlooked custom setting is volume control on what manufacturers like to call audio feedback, and what I like to call annoying beeps. If you want a truly reserved laptop, traveling beepless is the only way to go.

Armed with 640K, a second drive (and/or a RAM drive), Datavue's Spark has more than enough hardware, memory muscle, and battery life to handle essential on-the-road word processing and spreadsheet work. We encountered no problems running *1-2-3* or *XyWrite*. Communications should also be trouble-free since, for an extra $325, you can buy an internal 300/1,200-bps Hayes-compatible modem with two RJ-11 plugs that are supplied with *Crosstalk XVI*.

Originally announced in November 1986, the Spark has been slow getting to the store shelves. Datavue said shipments to dealers were to have begun April 15, with backorders continuing sometime into May.

According to the Datavue folks, another soon-to-be-shipped portable, the modular Snap 1+1, is slated for sophisticated laptop users. Designed to be broken down into two parts, a laptop front end and a plug-in expansion box holding either dual 3½-inch drives or a 20-megabyte hard disk, the Snap 1+1 comes with 512K bytes of standard memory, one half-card expansion slot, a choice of three changeable screens (including an amber gaslit screen), a full array of ports, and 4.77-MHz speed for a base price of $2,095. Should be nice if Datavue can work out the kinks in the Snap's distribution pinch.

But, the world being what it is, you have to take what you can get. And if you can, light a fire under your dealer to get you a Datavue Spark. It's a worthy buy.
—Greg Pastrick

COUNTERPOINTS

With its $995 price tag, the Datavue Spark will attract a lot of attention. It's a nice, serviceable machine, a little flimsy, but the deep discounting on competitors with more features is bound to blunt the assault.**—Bill Machrone**

Slightly odd keyboard layout aside, the Spark hit the mark: great keyboard feel, 9.54 MHz, and lively display for $995.**—Mitt Jones**

If Datavue wants to be in the major leagues permanently, it should pay more attention to quality control.
—Bill Howard

The Spark has the mix of features most people are looking for in a laptop: a decent screen, good size, light weight, good keyboard, acceptable speed, and outstanding price.**—Gus Venditto**

The closest thing to a disposable laptop that's ever been invented. The price is right, but somehow I'd rather it weren't.**—Paul Stafford**

GRID SYSTEMS CORP.

GRiDLite

Want a laptop that doesn't make you look like those nerds who carried a vinyl-covered Executive Snap-Lok briefcase all through college? A machine you don't have to sneak into the airplane bathroom to use, ducking your head to escape the contemptuous snorts of fellow travelers?

If you routinely wear pocket protectors and those little elastic strips that hold your glasses on, go ahead and buy one of the boring beige knee-bashers you see all around you. But if you want a little style, head for a GRiD Systems Corp.'s sales office and check out the new GRiDLite.

GRiD's been in the laptop computer business since 1982, when it introduced the Compass, an $8,000 10-plus-pound portable sheathed in black magnesium. Since then, GRiD machines have become progressively slimmer and more sophisticated. Today, the line includes the hard-disk, gas-plasma-display GRiDCase series specially "hardened" for field use, and the lighter, low-cost GRiDLite.

A sort of GRiDCase sport model, the

The GRiD Systems GRiDLite is yet another sleek portable from the company that has always made the best-looking laptops. This machine accommodates only one floppy drive, offering instead expanded ROM space for utilities. An external floppy disk drive is available as an option.

GRiDLite weighs only 9.7 pounds, has a supertwist LCD screen, and has a case of matte black plastic. Its $1,795 base price includes 128K bytes of RAM (expandable to 640K), a single 3½-inch floppy disk drive. There's also a carrying case and a slim manual that will get you up to speed. DOS 3.2 costs $150, and GRiD's InteGRiD interface software is $95. Both are accompanied by hefty binders of documentation.

COUNTERPOINTS

How'd they make the GRiDLite's screen so good? Toshiba, NEC, eat your hearts out.—**Bill Howard**

The Backspace key location—rightmost key, top row—spoils an otherwise nice machine.—**Mitt Jones**

You can add as much as a megabyte of EMS and a megabyte of RAM, and four ROM sockets are available for applications software. A $495 Hayes-compatible 1,200-bit-per-second modem completes the kit. There's also a $295 Epson-made external 3½-inch floppy disk drive whose slim design complements the GRiDLite. It's black, of course.

You'll have to make a little extra effort to find a GRiDLite (but the same is true of an Aston-Martin DB-6). GRiD sells only through its 22 direct sales offices in Europe and North America. Emphasis is on corporate contracts, and GRiD will customize software and burn-in ROMs (there's a $50 burn-in fee for each chip), provide on-site user training and support, and arrange volume discounts for large orders.

If you're tired of laptop computers that look like sewing machines or require upper legs as long as Patrick Ewing's, it might be worth a trip to one of those 22 sales offices. With its subtle, sloping, jet-black case, the GRiDLite won't tempt you to deny ownership when it rolls through the security check at the airport.

At 13¼ by 11¼ by 2½ inches, the matte black plastic case of the Japanese-made GRiD is the sleekest, most streamlined laptop computer around. Circuitry, battery pack, and ROM chip sockets are concealed by a slide-off panel behind the lid of the machine. Even the GRiDLite's back panel, with its RGB, serial and parallel outputs, and external floppy disk drive interface, is discreetly hidden behind a clever flop-down panel that can be used as a little stand to elevate the keyboard almost an inch off a desktop and provide a better typing angle.

The GRiDLite's solidly constructed top opens up to reveal a 6½- by 8½-inch screen—bigger than any other reviewed here. The blue-on-green enhanced LCD (GRiD says it was the first to implement supertwist technology in a laptop screen) is so legible that most people think it's backlit. The aspect ratio is 2:1, which means pie charts look like pies, not Twinkies.

TRADE-OFFS Alas, beauty is sometimes only skin deep, and there are trade-offs with this machine.

The GRiDLite will be the darling of airport Presidential Lounges, but don't plan on computing your way through a trans-Atlantic flight. The life of the GRiD's 9.6-volt rechargeable nickel cadmium battery is rated at 3 to 4 hours, but we had trouble getting more than 2 hours out of it, and that was with minimal disk access. After fully charging and draining the battery at least three times,

FACT FILE

GRiDLite
GRiD Systems Corp.
2535 Garcia Ave.
P.O. Box 7535
Mountain View, CA 94039
(415) 961-4800
List Price: With 128K RAM, $1,795; with 640K RAM, $2,395; 1,200-bps Hayes-compatible modem, $495; external 3½-inch disk drive, $295; DOS 3.2, $150; InteGRiD software, $95.
In Short: A lightweight (9.7-pound) single-floppy laptop with four ROM sockets and EMS expandability; requires DOS 2.0 or later. The GRiDLite will appeal to business users with customized applications and those with a sense of style. The best-looking laptop on the market today.

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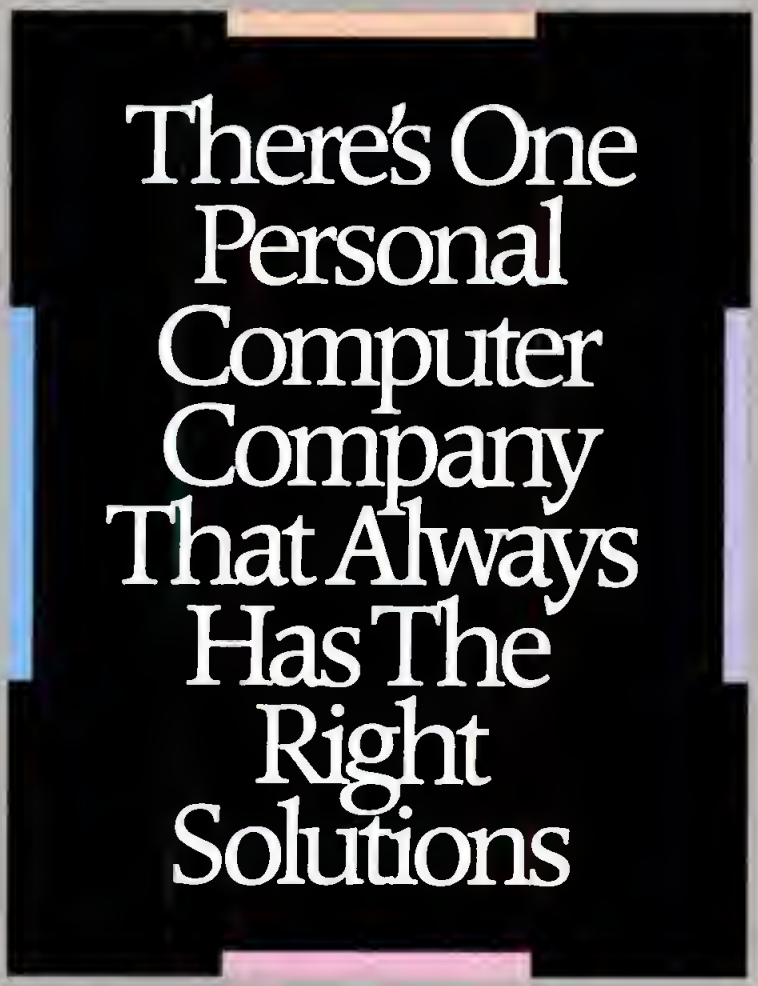

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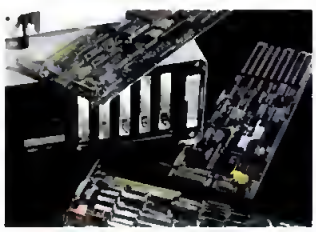

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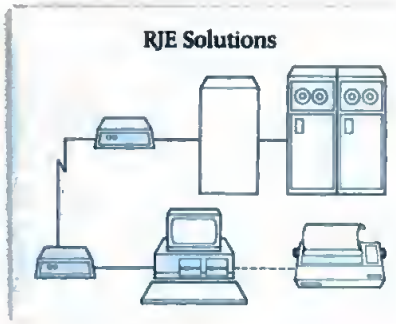

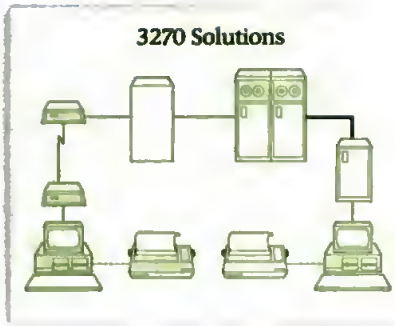

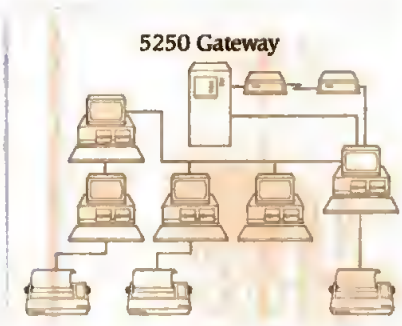

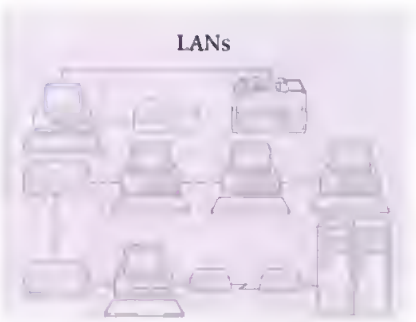

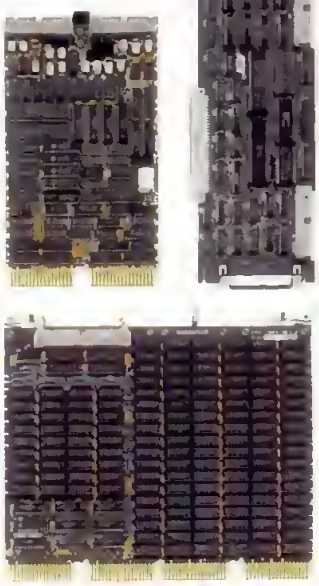

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Back

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we couldn't get more than 2½ hours use before the low-battery light came on. The machine ran for another hour (with the low-battery light on) before it shut down, but we wouldn't want to test that feature again with real data. The low-battery light also came on a couple of times when the machine was running off the AC adapter, suggesting the problem might be with the light rather than the battery itself. This plus an assembly problem with the serial interface—the bolts were too close to the interface itself, leaving no room for the cable to slide in—were the only real problems we found on the GRiDLite, and GRiD officials said that both could be attributed to the early model we had for review.

■ The GRiDLite is a competent, lightweight, low-cost unit that's perfect for customizing.

Nevertheless, competitive machines such as the Zenith Z-181 and Toshiba T1100 really do offer 4 and 5 hours of use, while the IBM PC Convertible gives you up to 8, though this is perhaps meant as compensation for internal injuries you'll suffer when the guy sitting in front of you in the airplane puts his seat back and the oversized case of the Convertible crushes your colon.

Most laptop keyboards have problems, and this one's no exception. If you're not a touch typist, you'll find this keyboard only mildly annoying. But if you're the kind of person who spends most of the day involved in high-speed keyboard antics, you are likely to be infuriated with it.

The keyboard is unusually cramped, with some odd key placements. The Del key has been exiled to the extreme upper-right-hand corner, where it languishes beside the Backspace key, making Ctrl-Alt-Del operations tedious for those of us who haven't practiced our piano scales lately. And until this magazine outlaws contractions, my copy will be full of typing mistakes on the GRiD, since the apostrophe key is a line *below* the home row instead of on the *same* row.

Numeric keys piggyback a cluster of alpha keys on the right-hand side of the keyboard and are accessed through a NumLock command. A NUMlock program is also available—stick it in your CONFIG.SYS file, and you can invoke it when you start out and have it in place throughout your session. Ten function keys are across the top of the keyboard; ten more can be activated by hitting the big Fn key to the left of the Spacebar. The keyboard has a firm, full-travel feel, and the slightly roughened surface of the keycaps gives a nice non-skid grip, good for breakneck-speed typing.

Expansion fanatics will bemoan the GRiDLite's single floppy disk drive and inability to accommodate a hard disk. GRiD officials say the intended customer is unlikely to need such storage, since most of the machines sold are fitted with custom software in ROM. Extra drives mean more weight and higher cost. For customers who really want it, there's the little external drive for $295.

In processor speed benchmark tests, the 80C88-based GRiD was faster than the Toshiba 1100, about 10 percent faster than a standard IBM PC, but a bit slower than the NEC MultiSpeed. Disk access is faster than all three, however, because the GRiD uses a true 16-bit bus that whips data through faster than 8-bit arrangements.

The GRiDLite's screen isn't as easy to read as the Z-181's, but it's better than the Toshiba, NEC, and the other LCD machines. Its base price is lower than any, but includes only 128K bytes of RAM. Fully loaded, it's $2,350. That's cheaper than the Zenith and a little more expensive than the Toshiba and NEC MultiSpeed.

The GRiDLite is a competent, lightweight, low-cost unit that's perfect for customizing. Are you in the market for a good-looking machine? This is the one. And after all, if you're shelling out a couple of thousand dollars, you have a right to something you won't be embarrassed to carry.—**Nora Georgas**

(continues)

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Laptop Computers: Summary of Features

(Products listed in ascending price order)

Product Manufacturer	Base price	CONFIGURATION: Minimum RAM	Maximum RAM	Standard disk drives	Microprocessor	Speed (MHz)	Expansion slots	Expansion chassis available	Monitor port: RGB, composite, or none	Serial port	Parallel port	Battery operated	Claimed battery discharge time (hours)
Datavue Spark Datavue Corp.	$995	384K	640K	1 3½-inch floppy disk	80C88	4.77/9.54	1	○	RGB, composite	●	●	●	8
Bondwell B Bondwell Industrial Co Inc	$1,295	512K	512K	1 3½-inch floppy disk	8088	4.77	None	○	RGB, composite	●	●	●	8
IBM PC Convertible IBM Corp.	$1,695	256K	640K	2 3½-inch floppy disks	80C88	4.77	1 proprietary	●	Proprietary	●	○	●	6–8
GRiDLite GRiD Systems Corp	$1,795	128K	640K	1 3½-inch floppy disk	80C86	4.77	None	○	RGB	●	●	●	3
NEC MultiSpeed NEC Home Electronics (U.S.A.) Inc	$1,995	640K	640K	2 3½-inch floppy disks	CMOS V30	4.77/9.54	None	●	RGB	●	●	●	4–6
Toshiba T1188 Plus Toshiba America Inc.	$2,099	640K	640K	2 3½-inch floppy disks	80C86 dual speed	4.77/7.16	1 proprietary	●	RGB, composite	●	●	●	7
Sharp PC-7108 Sharp Electronics Corp	$2,795	320K	740K	1 5¼-inch floppy disk, 20-Mbyte hard disk	80C86-2	4.77/7.37	2 proprietary	●	Optional RGB adapter	●	●	○	120-volt only
Data General One/Model 2T Data General Corp.	$2,895*	512K	2.5 Mbytes	1 3½-inch floppy disk, 10-Mbyte hard disk	80C88	4.77/7.16	2 proprietary 2 open	●	RGB, composite	●	●	●	1–5
HP Portable Plus (NR) Hewlett-Packard Co.	$2,995	512K	512K	None	80C88	4.77	2 short	○	None	●	Proprietary	●	20
GRiDCase 3 Plus (NR) GRiD Systems Corp.	$3,280	128K	640K	1 3½-inch floppy disk	80C88	4.77	1 combination	●	RGB	●	●	●	1–1½
Zenith Z-183 Portable PC Zenith Data Systems	$3,399	640K	640K	1 3½-inch floppy disk, 10-Mbyte hard disk	80C88	4.77/8	None	○	RGB, composite	●	●	●	2½
Wang LapTop Wang Laboratories Inc.	$3,530	512K	1 Mbyte	10-Mbyte hard disk	80C86	8	2 proprietary	○	RGB	●	●	●	4
Toshiba T3186 (NR) Toshiba America Inc.	$4,199	640K	2.6 Mbytes	1 3½-inch floppy disk, 10-Mbyte hard disk	80286	8	1 short	●	RGB	●	●	○	120-volt only
Compaq Portable III Compaq Computer Corp	$4,999†	640K	8.6 Mbytes	1 1.2-Mbyte floppy disk, 20-Mbyte hard disk	80286	12	2 proprietary	●	RGB	●	●	○	120-volt only

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable NR—Not reviewed for this article; see review in Volume 5 Number 22. *Configured with 10-Mbyte hard disk drive.

	STANDARD SOFTWARE					OPTIONS				
Battery recharge time (hours)	Disk-based	ROM-based	DOS version supplied	Runs PC-DOS 3.2	Concise portable documentation	Hard disk drives	Floppy disk drives	Car battery adapter	Carry case	Modem
8	None	None	2.11	●	○	None	3½-inch, $200 5¼-inch, $210	None	Optional	$325
8	GW-BASIC, communications	None	2.11	●	○	None	3½-inch, $399.95 5¼-inch, $379.95	None	Optional	Standard (300-bps)
8	Editor, communications	None	None; 3.3 optional ($120)	●	○	None	3½-inch, $170	Optional	Optional	$225
8	None	BASIC	None; 3.2 optional ($150)	●	●	None	3½-inch, $295	Optional	Standard	$495
8	Productivity utilities	Outliner filer, report writer, dialer, communications	3.2	●	○	None	None	Optional	Optional	$399
8	*SideKick*	None	3.2	●	○	None	None	Optional	Optional	$399
120-volt only	Wang system shell, editor, utilities	None	2.11	●	○	20-Mbyte hard disk standard	None	120-volt only	Optional	$255
12, 2 with optional Quick-charge	None	None	3.2	●	○	10-Mbyte hard disk standard	5¼-inch, $795	Optional	Optional	$400
12	None	None	2.11	○	○	None	3½-inch, $795 (HPIL interface)	None	Standard	$495
12	None	None	None; 3.2 optional ($150)	●	●	10-Mbyte hard disk ($975)	3½-inch, $295	Optional	Standard	Standard
8	*Microsoft Windows*	None	3.2	●	○	10-Mbyte hard disk standard	5¼-inch, $399	None	Optional	$399
8	None	None	3.2	●	○	10-Mbyte hard disk standard	3½-inch, $518 5¼-inch, $385	Optional	Standard	$425
120-volt only	*SideKick*, *SuperKey*	None	3.2	●	○	10-Mbyte hard disk standard	None	120-volt only	Standard	$399
120-volt only	None	None	None; 3.2 optional ($95)	●	○	20-Mbyte hard disk standard	None	120-volt only	Optional	$399

†Configured with 20-Mbyte hard disk drive; dual floppy disk and 40-Mbyte configurations also available

Laptop Computers: Summary of Measurements

(Products listed in ascending price order)

	MEASUREMENTS							SCREEN				KEYBOARD		
Product Manufacturer	Height (inches)	Width (inches)	Depth (inches)	Base weight (lbs.)	Travel weight (lbs.)	Handle	"Lapability"	Height (inches)	Width (inches)	Type	Readability	No. of keys	Feel	Layout
Datavue Spark Datavue Corp.	2.4	12.5	13	10.43	11.51	●	G	4.5	9.5	Supertwist LCD	F	77	VG	G
Bondwell 8 Bondwell Industrial Co. Inc.	3.1	12.2	11.5	10.54	12.14	●	VG	3	9	Backlit supertwist LCD	F	76	F	F
IBM PC Convertible IBM Corp.	2.7	12.8	14.7	12.67	14.29	●	P	3.75	10.25	Supertwist LCD	F	78	E	VG
GRiDLite GRiD Systems Corp.	2.6	13.25	11.25	9.70	11.60	○	G	6.5	0.5	Supertwist LCD	VG	71	G	F
PC **NEC MultiSpeed** NEC Home Electronics (U.S.A.) Inc.	3.0	13.6	13.6	11.45	12.01	●	G	4	10.5	Backlit supertwist LCD	G	85	VG	E
PC **Toshiba T1100 Plus** Toshiba America Inc.	2.6	12	12.1	9.90	11.43	●	VG	4.7	9.1	Supertwist LCD	G	81	VG	VG
Sharp PC-7100 Sharp Electronics Corp.	0.5	16.1	6.3	20.60	20.60	●	N/A	4.5	9.5	Backlit supertwist LCD	E	84	F	E
Data General One/Model 2T Data General Corp.	3	11.25	14	13.30	15.27	●	F	0.5	0	Backlit supertwist LCD (nonglare)	VG	80	G	F
HP Portable Plus (NR) Hewlett-Packard Co.	3	10	13	9.5	Info. not available	●	F	4	9.75	LCD (nonglare)	F	79	P	P
GRIDCase 3 Plus (NR) GRiD Systems Corp.	2	11.5	15	13.1	Info. not available	●	G	4	0.5	Plasma	E	71	E	G
PC **Zenith Z-183 Portable PC** Zenith Data Systems	3.25	13.75	13	15.40	17.01	●	F	0	0	Backlit supertwist LCD (nonglare)	E	78	VG	VG
Wang LapTop Wang Laboratories Inc.	4	11.9	13.9	14.42	17.07	○	F	4	9	Supertwist LCD (nonglare)	G	91	G	P
Toshiba T3100 (NR) Toshiba America Inc.	2	11.5	12	14.6	Info. not available	●	F	5.9	7.7	Plasma (nonglare)	E	81	E	VG
Compaq Portable III Compaq Computer Corp.	9	15.5	7.5	20.88	20.88	●	N/A	5.5	8.5	Plasma	E	84	VG	E

PC —Indicates Editor's Choice ●—Yes ○—No E—Excellent VG—Very good G—Good F—Fair P—Poor N/A—Not applicable NR—Not reviewed for this article; see review in Volume 5 Number 22.

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IBM PC Convertible

IBM Corp. has taken its share of knocks for its PC Convertible. Critics would say that it doesn't nearly compensate for the knocks weary Convertible owners have taken on their shins, lugging the long beige box on their travels.

The laptop lost points the last time we reviewed it (July 1986) for not offering a Hayes-compatible modem, for having a top memory of only 512K (building from the standard 256K), and for its lack of ports as standard equipment.

IBM has shown it can learn from its customers. It added a Hayes-compatible modem to the list of options (although third-party manufacturers had already filled the void). It improved the LCD screen by using supertwist technology, and made the new screen available to current users for $225 (the screen is easily detached). It raised the RAM limit to 640K bytes by adding a 256K card in addition to the 128K card it was selling. And it recently cut the price to $1,695, one of the lowest list prices among its peers.

But that list price only gets you a 256K computer with no serial or parallel ports, only a connector for IBM's special Convertible printer, and the ability to plug in IBM's proprietary Convertible monitor. Ports, 640K bytes of RAM, and an adapter for a standard PC display all cost extra. Among the heaviest of laptops, the Convertible displays very little of the ergonomic expertise IBM prides itself on. An unwieldy bar handle constantly forces you to shift the machine as you carry it, searching for the center of gravity.

The collapsible display unfolds to a maximum opening of 120 degrees, preventing you from catching the best available light. The new screen is a welcome improvement over the original, but it is still workable only in good lighting; on an airplane or train you'll be able to use it only near a window, in the sun. I have used it on night flights, but found myself constantly straining to find the cursor. Like most laptops, disk access time is excruciatingly slow. Screen writing is so slow you can count the rows as a spreadsheet slowly unfurls down the screen.

Aside from disk access and screen writing, performance is on a par with a 4.77-MHz XT. Compatibility is not an issue, once you've transferred programs and data to 3½-inch disks. The Convertible will run in either MDA or CGA modes, selectable through its configuration program.

The keyboard is a pleasure to use. It is far and away the best keyboard on a laptop. The only limitations are due to shared use of certain keys. The arrangement includes the arrow keys doubling as Home, PgUp, PgDn, and End when the

IBM has made significant improvements to the PC Convertible since we last reviewed it. New standard features include 640K RAM and a supertwist LCD. A Hayes-compatible modem is a welcome option. Best of all, a price cut has lowered the Convertible's base price to $1,695.

FACT FILE

IBM PC Convertible
IBM Corp.
Consult your local authorized dealer.
List Price: $1,695; display adapter, $255; serial/parallel adapter, $80; 256K memory card, $345; 128K memory card, $160; internal Hayes-compatible modem, $450; internal IBM standard modem, $225; DOS 3.3, $120.
In Short: A bulky but sturdy XT-compatible laptop; requires DOS 3.3. Newly enhanced screen brings it up to par with most laptop displays. Has a great keyboard and helpful RAM-saving feature.
CIRCLE 668 ON READER SERVICE CARD

COUNTERPOINTS

The PC Convertible weighs and costs nearly as much as the Compaq Portable III and works nearly as well as the Bondwell 8. You can't possibly take this computer seriously.
—Paul Stafford

They improved the display? Could've fooled me. IBM also missed the boat by not upgrading to the 1.4-megabyte capacity disks when they brought out the PS/2 desktops.**—Bill Howard**

OK, so the screen is mediocre and the machine could be lighter. But as usual, the IBM keyboard is tops. I like it.
—Mitt Jones

Yeah, but you need four-foot-long thighs to use it.**—Nora Georgas**

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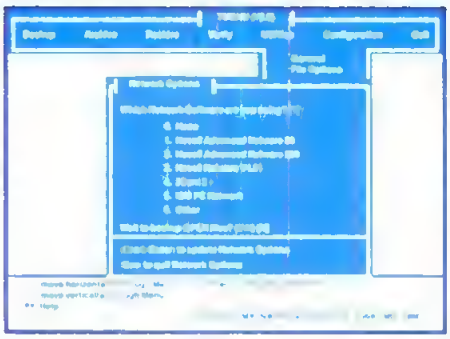

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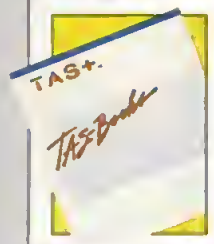

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Fn key is held down. A numeric keypad carves a place for itself out of the right side of the alphanumeric keypad, doubling J-K-L as 1-2-3, and so on.

The battery charge is among the longest available; it's rated at 6 to 8 hours on a single charge, but I've used it for more than 9, with regular disk accesses.

The Convertible's best feature is the RAM-saving option. You can configure the Convertible to store the entire contents of memory when you power down. Next time you turn it on, it starts out exactly as you left it.

It's a sturdy machine, built to take the knocks of the road. But with a cruising weight of 14.3 pounds, it's a machine best carried by strong arms and sturdy knees.—**Gus Venditto**

NEC HOME ELECTRONICS (U.S.A.) INC.

NEC MultiSpeed

What makes a great laptop computer? A readable screen, a keyboard that doesn't skimp, and power to burn. When NEC Home Electronics (U.S.A.) Inc. first announced its MultiSpeed, the general reaction was "two out of three ain't bad." It tore the top off every benchmark test. Its keyboard was somewhere between wonderful and terrific. But the much-ballyhooed screen was, frankly, as murky and awful as most of its competitors.

NEC initially tried blunting the criticism, but finally saw the light. Or in this case, the backlight. It helped that the MultiSpeed's engineers designed the original screen to be removable. And it didn't hurt that NEC already manufactured backlit electroluminescent panels that it sold to other computer makers. So as of June 1, the new MultiSpeed EL ($2,499) sports a muted version of the bright blue backlit screen that has hooked so many Zenith and Sharp customers. Current MultiSpeed owners can upgrade to the new screen for $499.

The screen isn't nearly as radiant (or as large) as Zenith's throbbing flat panel display, but will appeal to users who like to work under glaring lights. Zenith refined the front surface of its screen to a matte finish, which prevents ambient light from interfering with the backlighting. In a normal room the Zenith screen is clear and crisp; in dim lighting it's downright awesome. But its backlighting is overpowered and thin in extra-strong light or in direct sunlight.

NEC tuned its backlit screen to work well under all lighting conditions. At a typical library desk, or in a dim terminal, Zenith's machine clearly has an edge. But in the glaring overkill of today's office lighting, or alfresco, the NEC screen is a real contender. So is the rest of the machine. NEC built the MultiSpeed around its own CMOS V30 CPU (an optimized version of the Intel 8086) that runs at a scorching 9.54 MHz. And it found a way to give users the next best thing to a genuine PC keyboard, complete with function keys where they belong at the left edge of the chassis, and a dedicated numeric/cursor keypad.

The newly backlit screen can tilt through a wide viewing arc, and is coupled to the chassis with a friction fitting that's head and shoulders above the quirky mechanism on older models. NEC also tossed in a 128K battery-backed-up static RAMdisk and a half-megabyte pile of firmware. The RAMdisk comes in handy. The firmware was a

NEC's MultiSpeed is the most successful newcomer to the portable PC fray. Its 9.54-MHz speed, above-average keyboard, decent display, and thoughtful standard features combine to make it an Editor's Choice on its debut appearance. The new display makes it unbeatable in its class.

COUNTERPOINTS

The extra bulk of the MultiSpeed compared with the T1100 Plus provides room for function keys along the left (old PC style) and a separate numeric keypad. I'd rather have the smaller footprint. The 9.54-MHz clock speed is a treat.—**Bill Howard**

■ NEC built the MultiSpeed around its own CMOS V30 CPU (an optimized version of the Intel 8086) that runs at a scorching 9.54 MHz.

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■ LAPTOPS

nice try, but NEC forgot that most MultiSpeed purchasers already have a desktop machine and prefer their own applications. The built-in outliner, file manager and report writer, notepad with spelling checker, dialer, communications program, and setup program aren't going to win many converts, but may appeal to some first-time owners.

Most laptop manufacturers compromise on their keyboards, but not NEC. Its responsive 85-key keyboard comes closest to giving users the familiar IBM layout and feel. Each key is close to where it belongs; with most other laptops you have to retrain your fingers or pound away at special Fn buttons to make keys do double duty. The MultiSpeed's numeric/cursor keypad does take some getting used to, since it's positioned above the normal top row, but it's far more convenient than the sharing arrangements foisted off by competitors. It's not perfect—the Enter key is a bit small and too far away from the numeric keypad. But NEC added some nice touches, such as scooping out the home-row F and J keys to speed finger positioning. And the LED shift indicators are in their proper places directly atop the relevant keys.

Each machine comes standard with parallel, serial, RGB, and external floppy ports, 640K bytes of RAM, twin 3½-inch side-mounted floppy drives, and a handle that extends out from the back and doubles as a lock on the battery case. For some reason, NEC left the back panel exposed and the ports uncovered. After a few months of New York grime, I practically had to scrape the dust off them with a trowel.

The main nickel cadmium battery is relatively small and simple to snap in and out. A separate battery powers the 128K bytes of static RAM, which stores the system configuration, user phone directory, and other RAMdisk data. When the power gets dangerously low an alarm flashes a warning LED, paints a message on-screen, and beeps. But you get no warning at all if you close the cover without first turning the machine off.

One smart safety feature will save a

(continues)

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

NEC MultiSpeed
NEC Home Electronics (U.S.A.) Inc.
1255 Michael Dr.
Wood Dale, IL 60191
(312) 860-9500
List Price: With 640K RAM, 9.54/4.77-MHz software selectable V30 CPU, MS-DOS 3.2, twin 3½-inch floppy disk drives; detachable screen; and 512K of ROM-based applications; $1,995; Model EL with backlit screen, $2,499; 300/1,200-bps modem, $399; external transfer cable kit (for PCs and XTs), $99; serial transfer kit, $159; RS-232 cable for external modem, $49; RS-232 null modem cable, $49; printer cable, $49; automobile power cable, $20; carrying case, $99; extra nickel cadmium battery, $99.
In Short: A jet-propelled 9.54-MHz V30 CPU, near-perfect keyboard, vastly improved backlit supertwist screen, and an aggressive price make the NEC MultiSpeed a real winner. The screen isn't as good as the Zenith's, but it packs more muscle for less money.

CIRCLE 667 ON READER SERVICE CARD

COUNTERPOINTS

The new backlit screen and extended battery life make the MultiSpeed a whole lot more desirable than before. The in-between screen size is easier on the eyes than that of the Toshiba 1100 Plus, yet stops short of Zenith's enormous flapping barn door. Style counts for something when you're toting a laptop, and the MultiSpeed comes up short in my book. It reminds me too much of last-generation Toyotas: an inharmonious blend of curves, angles, and fillets.
—Bill Machrone

The MultiSpeed comes close to being the perfect laptop. Once NEC improves the screen quality, it will have the last word.**—Gus Venditto**

The only one of the pack that aligns the function keys in two columns on the left—great for a *WordPerfect* user. But why is the Return key spaced one key too far to the right? Unless you're a two-finger typist, this 9.54-MHz baby's going nowhere fast.
—Mitt Jones

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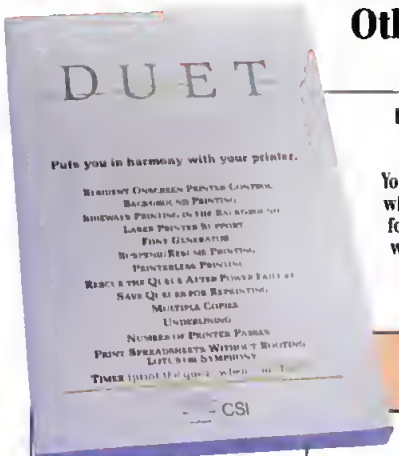

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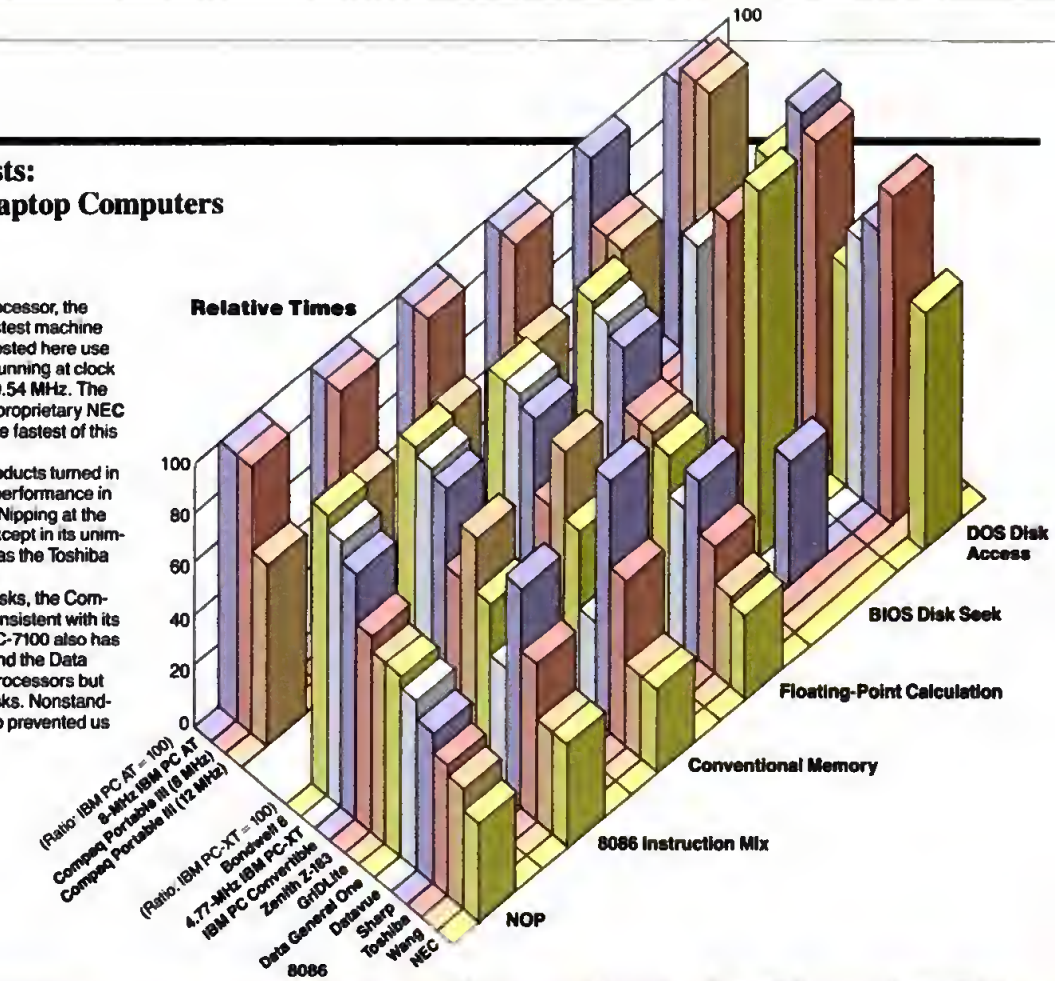
CIRCLE 213 ON READER SERVICE CARD

Benchmark Tests: Portable and Laptop Computers

With its 12-MHz 80286 microprocessor, the Compaq Portable III is the fastest machine reviewed here. The other laptops tested here use assorted 8086-based processors running at clock speeds ranging from 4.77 MHz to 9.54 MHz. The NEC MultiSpeed, equipped with a proprietary NEC V30 chip running at 9.54 MHz, is the fastest of this class of laptop.

The Data General and Zenith products turned in the fastest display times, but their performance in other tests was less than startling. Nipping at the heels of the leaders in every test except in its unimpressive floppy disk access time was the Toshiba T1100 Plus.

Of the five machines with hard disks, the Compaq gave the best performance, consistent with its 12-MHz clock speed. The Sharp PC-7100 also has a speedy drive. The Zenith Z-183 and the Data General One/Model 2T have fast processors but are hampered by XT-class hard disks. Nonstandard BIOS calls on the Wang LapTop prevented us from testing its hard disk.



Performance Times
(Times given in seconds except where noted)

	NOP	8086 Instruction Mix	Conventional Memory	Floating-Point Calculation	BIOS Disk Seek (milliseconds)	DOS Disk Access (milliseconds)
8-MHz IBM PC AT (1.2-Mbyte floppy disk drive)	4.2	9.0	1.3	36.0	37.0	180.5
Compaq Portable III (8 MHz)	4.2	9.1	1.3	35.7	27.8	190.5
Compaq Portable III (12 MHz)	2.8	6.1	0.9	23.8	27.4	190.5
Bondwell 8 (4.77 MHz)	10.8	33.2	6.0	164.3	N/A(1)	242.0
4.77-MHz IBM PC-XT (360K floppy disk drive)	10.1	32.0	5.9	159.2	95.6	242.3
IBM PC Convertible (4.77 MHz)	9.4	31.0	5.7	150.5	N/A(1)	308.1
Zenith Z-183 Portable PC (8 MHz)	7.5	22.1	4.0	114.2	113.8	295.4
GridLite (4.77 MHz)	7.0	28.3	5.5	113.8	N/A(1)	N/A(2)
Data General One/Model 2T (8 MHz)	6.8	21.8	4.0	108.5	148.2	200.7
Datavue Spark (9.54 MHz)	6.5	15.4	2.2	84.6	N/A(1)	239.1
Sharp PC-7100 (7.37 MHz)	5.7	26.7	5.7	109.9	45.0	258.7
Toshiba T1100 Plus (7.16 MHz)	4.9	19.2	3.7	76.9	N/A(1)	301.6
Wang LapTop (8 MHz)	4.5	12.6	1.9	54.2	N/A(2)	N/A(2)
NEC MultiSpeed (9.54 MHz)	3.7	12.4	1.9	51.3	N/A(1)	220.8

N/A—Not applicable: (1) no hard disk in system; (2) nonstandard disk calls.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

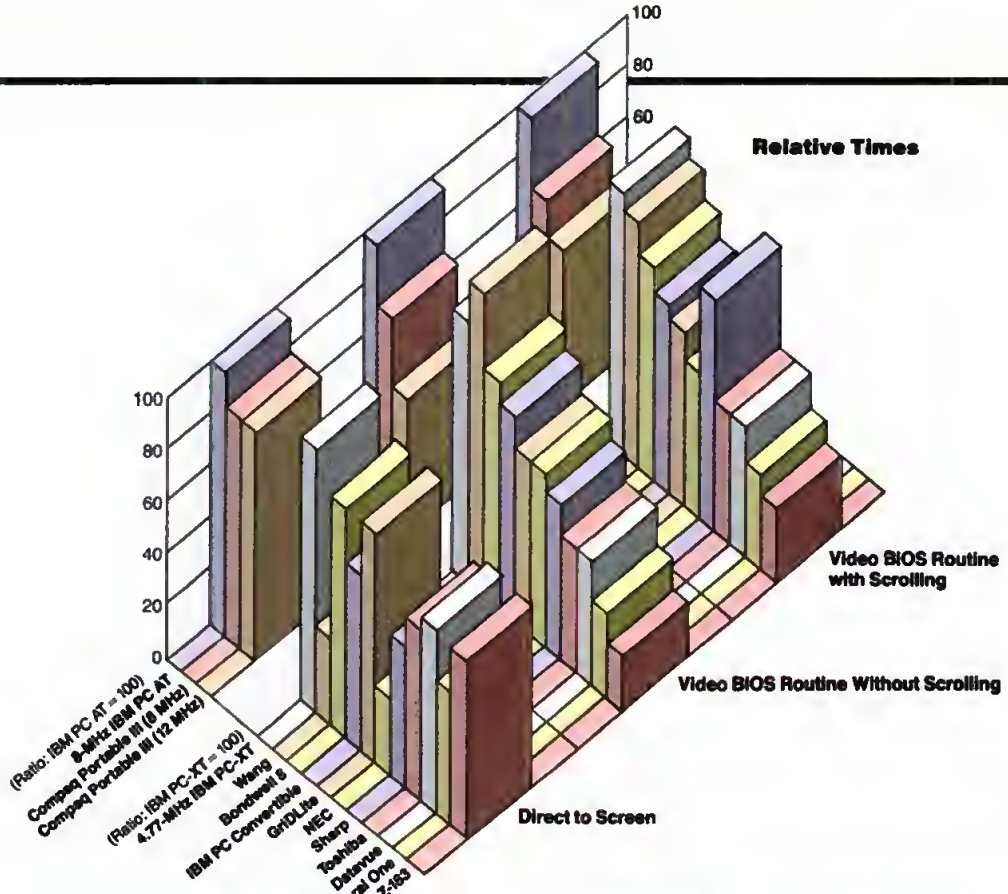
The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

The **DOS Disk Access** benchmark test measures the time



Performance Times
(Times given in seconds except where noted)

	Direct to Screen	Video BIOS Routine Without Scrolling	Video BIOS Routine with Scrolling
8-MHz IBM PC AT (1.2-Mbyte floppy disk drive)	4.9	4.5	7.6
Compaq Portable III (8 MHz)	4.3	3.5	5.8
Compaq Portable III (12 MHz)	4.3	2.3	4.5
4.77-MHz IBM PC-XT (360K floppy disk drive)	11.6	17.3	23.3
Wang LapTop (8 MHz)	3.8	19.9	21.7
Bondwell 8 (4.77 MHz)	10.1	15.0	19.1
IBM PC Convertible (4.77 MHz)	7.6	13.8	18.8
GridLite (4.77 MHz)	10.1	11.5	15.8
NEC MultiSpeed (9.54 MHz)	3.4	11.4	12.9
Sharp PC-7100 (7.37 MHz)	6.2	10.2	20.7
Toshiba T1100 Plus (7.16 MHz)	7.5	8.2	11.5
Datavue Spark (9.54 MHz)	8.1	8.0	11.8
Data General One/Model 2T (8 MHz)	5.8	5.7	8.5
Zenith Z-183 Portable PC (8 MHz)	7.9	3.8	6.7

t takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times.

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times. The result shown is the total of the ten trials.

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

Benchmark Test: Portable and Laptop Battery Life

Battery life is important to laptop users, and this bunch of products showed a wide variation that ranged, for floppy disk operation, from the GRiDLite's 2.3 hours to the IBM PC Convertible's 7.3 hours and, for hard disk operation, to the Zenith's time of almost 5 hours with a hard disk running. (The Zenith's screen backlighting turns off automatically after several seconds of keyboard inactivity, while that of other screens stays on.) Two top performing portables, the Compaq Portable III and Sharp PC-7100, could not be tested because they can't run on battery power.

	Drive Type	Battery Life (hours)
NEC MultiSpeed (9.54 MHz)	Floppy disk	4.5
Wang LapTop (8 MHz)	Hard disk	2.4
Toshiba T1100 Plus (7.16 MHz)	Floppy disk	6.1
Datavue Spark (9.54 MHz)	Floppy disk	3.8
Data General One Model 2T (8 MHz)	Floppy disk	2.8
Data General One Model 2T (8 MHz)	Hard disk	2.2
GriDLite (4.77 MHz)	Floppy disk	2.3
Zenith Z-183 Portable PC (8 MHz)	Hard disk	4.9
IBM PC Convertible (4.77 MHz)	Floppy disk	7.3
Bondwell 8 (4.77 MHz)	Floppy disk	5.8

For the **Battery Life** benchmark tests, each laptop battery was fully charged, then made to run a batch file that looped through 45 lines of REM statements and wrote the time to a disk file on the laptop's hard or floppy disk. The batch file was run until the system failed, then the time was recorded using the time-stamp. Hard disk machines were tested with and without the hard disk running.

lot of grief—popping up one of the MultiSpeed's firmware programs while an application is running freezes that application. If you try to quit while an application is temporarily frozen unseen in the background, an electronic override prevents you from turning the computer off and losing your work.

■ The MultiSpeed's breakneck speed will take your breath away.

To shuttle information back and forth between the MultiSpeed and any desktop, NEC provides a rear-panel port that hooks the two together. An optional $99 external transfer cable kit taps into the external floppy disk controller port on PCs and XTs, effectively turning the MultiSpeed's two 3½-inch disk drives into additional desktop drives. Owners of ATs and other machines without external floppy disk ports can purchase a serial transfer kit (at the same price) that will handle the exchange.

Best of all, the MultiSpeed lists for only $1,995—and is selling these days by mail order for as little as $1,395. That's an astonishing amount of power at an extremely aggressive price. Although the overall styling is swoopy and overly busy, the MultiSpeed's keyboard is as good as it gets, and the breakneck speed will take your breath away. Its vastly better screen could be a bit bigger and brighter, and a hard disk would be welcome, but if you need the most computer muscle at the best possible price, snap this one up. You won't regret it.

—Paul Somerson

SHARP ELECTRONICS CORP.

Sharp PC-7100

Imagine that you have an Acura Legend and a Plymouth Voyager in your garage. The upmarket, leather-interior Honda is the real you, the machine you want the world to know you by, but you find you spend more time in the minivan because, unsexy as it is, the Plymouth hauls kids, commuters, and cargo in workmanlike fashion.

That's the story with Sharp Electronics Corp.'s Sharp PC-7100, a $2,795 fast-XT-class lunchbox machine with a 45-millisecond 20-megabyte hard disk. The lunchbox-with-handle styling is thoroughly unremarkable, and it lacks the cachet a 12-MHz 80286 adds to the lookalike Compaq Portable III. No one will mistake the Sharp for a black-magnesium-case GRiD.

However, the AC-only Sharp gets the job done without complaint—or excitement. It's an affordable (fairly), competent tool.

In order to be competitive, Sharp needs to cut several hundred dollars off the list price and improve the screen. With a modem, a full complement of

FACT FILE

Sharp PC-7100
Sharp Electronics Corp.
Sharp Plaza
Mahwah, NJ 07430-2135
(800) 526-0264
(201) 529-9500
List Price: With 20-Mbyte hard disk, 5¼-inch floppy disk drive, 320K RAM, DOS 2.11, $2,795; Model PC-7000A, with two 5¼-inch floppy disk drives, $1,795; 320–704K RAM upgrade, $79 per 128K (three required); external video adapter, $285; expansion box (three expansion slots), $400; CE-700P printer, $449; backlight replacement, $59; 1,200-bps internal modem, $255; carrying cases, $75 and $85.
In Short: Undramatic and unsexy but very workmanlike. A fast, lunchbox-style XT-compatible portable that weighs 21 pounds and operates on AC only. Has an AT-caliber 20-Mbyte hard disk, 5¼-inch floppy disk drive, and a passable backlit LCD screen. Priced a bit too high.

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CIRCLE 205 ON READER SERVICE CARD

Like the Compaq Portable III, the Sharp PC-7100 has a lunchbox design with a keyboard that fastens in front when not in use. Unlike the Compaq, it offers only XT speed. But if you want a hard disk at a fair price and the bulk doesn't bother you, the PC-7100 merits a look.

RAM, and a video adapter, it lists for $3,686. The display is only mediocre, and some of Sharp's options are standard features elsewhere.

The 5¼-inch floppy disk drive is preferable because you never have to worry about two disk sizes. Too many power users forget the grief that 3½-inch disks cause for real people. IBM's PS/2 announcement may force the world to 3½ inches, but for now and the immediate future, there's no question which way is easier.

COUNTERPOINTS

The Sharp PC-7100 equals the Portable III on the really important features; the only thing you miss is speed. It's perfect for anyone on a budget.
—Gus Venditto

A great machine for a good price, but do you really want to carry it?
—Mitt Jones

In PC Labs tests, the PC-7100 performed about as you'd expect for an 80C86-2–based machine with 4.77- and 7.37-MHz clock speeds. At the higher setting, operations are 20 to 75 percent faster than in a stock PC or XT. The 3½-inch, 20-megabyte hard disk's 45-millisecond average access time ranks in the AT class. Compare it, for instance, to the 150-plus-millisecond slug on the Toshiba T3100.

Can you live with a second floppy disk drive in place of the hard disk? Sharp also has the similar PC-7000A for $1,795.

The detachable keyboard has 84 keys, with a number/cursor pad and 10 function keys along the top. The keyboard appears to be solid; it just doesn't feel that way. A Setup key lets you change screen brightness, cursor shape and blink rate, time and date, processor speed, speaker level, and backlighting time-out. (The backlight panels have finite lives, so even on AC units with no battery-life concerns, the displays need blanking features.) A clear plastic panel lets you slide function key assignments next to the function keys.

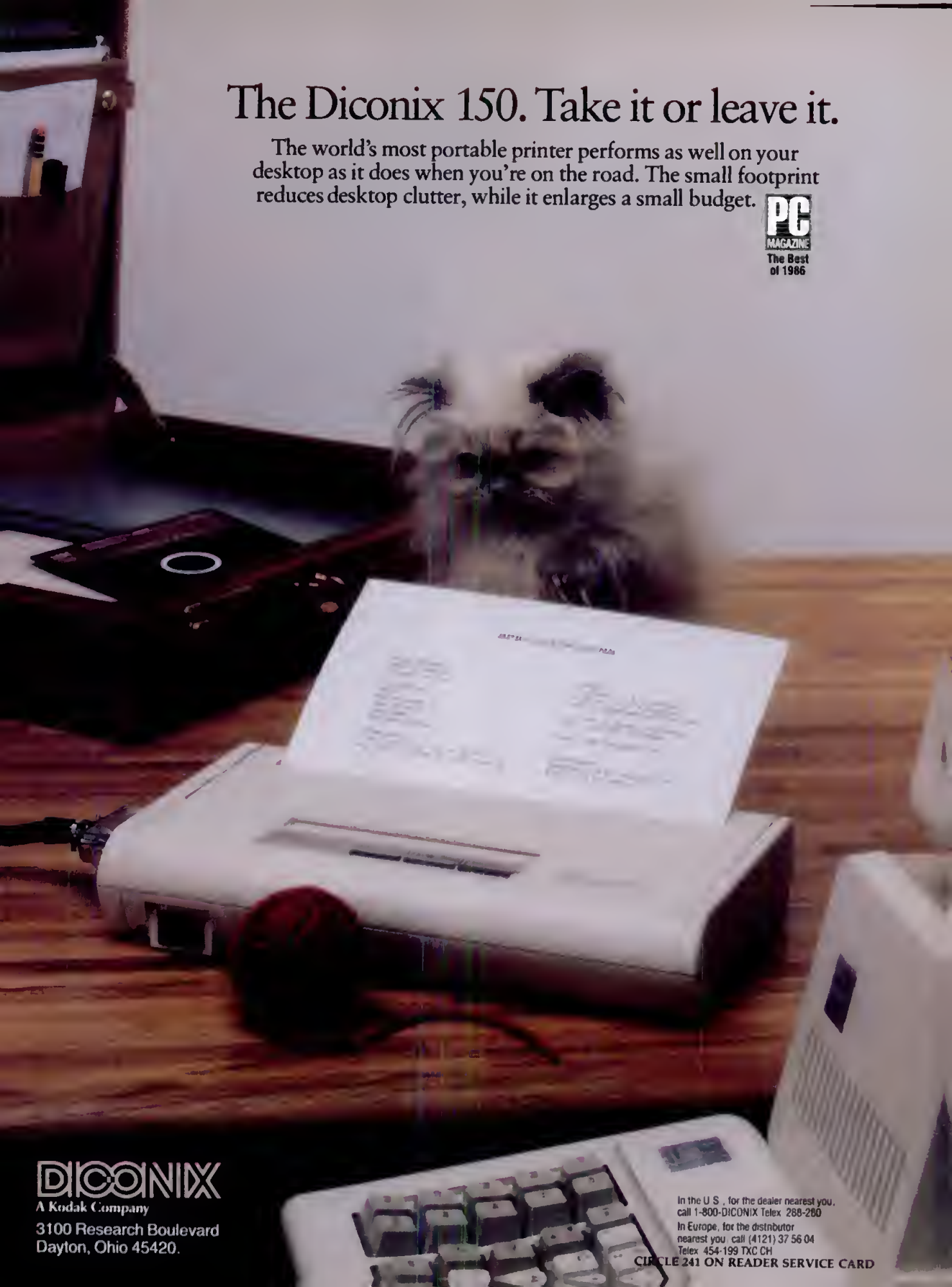
Inside, there's room for an 8087 math coprocessor, a $255 1,200-bit-per-second Hayes-compatible modem, and a CGA color/monochrome monitor adapter for desktop CRTs. Sharp deserves credit for including the monochrome capability (most portables don't), but a slap on the wrist for not making the video adapter a standard feature, as it is on most other portables.

Drawbacks? With RAM so cheap, Sharp should be shipping more than 320K in the base unit (a 384K upgrade to 704K, using 4-bit by 64K-bit chips costs $237 through Sharp). The backlit 9⅜-by 4-inch LCD screen presents no technological breakthroughs and, like many of the other LCDs that we reviewed, is overly long, so a circle comes out looking like a football. A standard CRT has an aspect ratio of 4:3 (wide to high); this one is about 7:3. The speaker's tinny error beep sounds like a cheap door buzzer muffled by a pillow.

Like everyone else, Sharp supplies only a husky desktop reference binder and a paperback DOS manual. Why don't the people who make portable computers think about portable manuals? They could create a plastic-coated 24-page command/setup/operations summary, burn the vital information into ROM, or stamp it onto the bottom or back of the case.

■ If you buy the Sharp PC-7100, you won't be disappointed, but it won't improve your social standing either. This is a workhorse, not a show horse.

If you buy the Sharp PC-7100, you won't be disappointed, but it won't improve your social standing, either. This is a workhorse, not a show horse.
—Bill Howard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CIRCLE 241 ON READER SERVICE CARD

EYEFULS AND EYESORES

Our 11 test laptops showed a wide variation in display quality. Most manufacturers use enhanced, or supertwist LCD technology in their screens. The next step toward improved legibility is the backlit LCD—the best examples being Zenith's Z-183 and the new NEC MultiSpeed. At the top of the screen readability scale is the gas plasma screen used in the Compaq Portable III. Gas plasma screens are sharp and legible, but require so much power that they're better left to AC-only machines like the Compaq. Display technology isn't the only thing that matters in a laptop screen: The degree to which the screen can be tilted, brightness and contrast control, glare protection, and the size of the characters all influence overall legibility.

The Data General One/Model 2T has a tall LCD screen that is easy to read when backlit. When the display is not backlit, legibility is worse. Nevertheless, this screen is miles ahead of its ancestors.

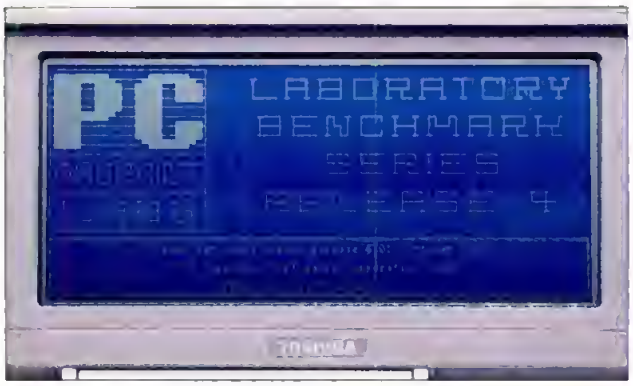
You'll need to use the backlighting that is a standard feature of the Bondwell 8's small screen all the time. The LCD characters are tiny and rather hard to read when lighting conditions are not ideal.

The Datavue Spark's supertwist LCD is difficult to read in less than ideal lighting conditions. An electroluminescent screen is available as a $125 option, and it's a good investment.

The Compaq Portable III's brilliant orange gas plasma display turns heads. The screen is as legible as a CRT in any light and helps make the Portable III worthy of consideration as a desktop machine.

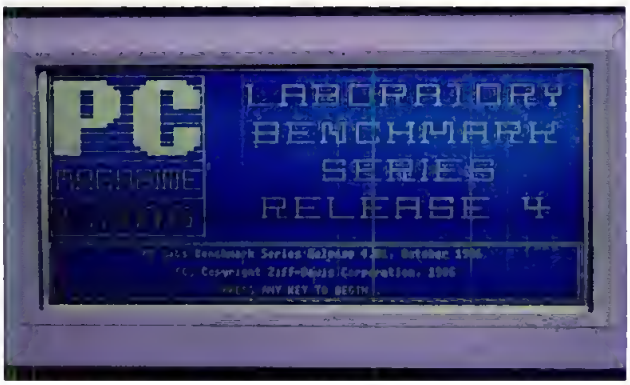
The GRiDLite's blue-on-green supertwist LCD looks backlit, even though it isn't. It measures a huge 6½ by 8½ inches. Other manufacturers could learn a few things from this display.

IBM has improved its display, adding supertwist technology. Even so, you'll need good light to read the characters clearly, and the screen size is not as large as some of the less expensive competition's.



Toshiba's T1100 Plus sports a new supertwist LCD screen that ranks among the better non-backlit screens, though the GRiDLite's is better. With each upgrade, Toshiba does a bit better than before.

The newly backlit display of the NEC MultiSpeed is a good choice for users who like to work in very bright light. The electroluminescent screen is standard on the EL model and available as a $499 upgrade.



The Wang LapTop's supertwist LCD is adequate, but that isn't good enough where laptops are concerned. Though legibility is acceptable, the screen should be better considering the unit's price.

The Sharp PC-7100's backlit display is long and wide. It is functional but not notable when compared with the Compaq or Zenith. For a portable that's so heavy, the display should be more dazzling.

The best gets even better. The vibrant Z-183 Portable PC screen (also found on the revised Z-181) still takes your breath away. It makes the Z-183 the only truly viable battery-powered desktop machine.

Photographs: Thom O'Connor

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CIRCLE 197 ON READER SERVICE CARD

KEY PLAYERS

Next to the screen, a laptop's keyboard is probably its most important element, and the one people argue most about. No laptop maker (except maybe IBM) has been able to duplicate the feel, size, and key placement characteristic of desktop PC keyboards, and there's still room for improvement on most of these machines. What to look for: Keys that are big enough so your fingers can find them and won't slide off, large and accessible function keys, separate numeric keypad, intelligently placed cursor movement, Ctrl, Alt, Del, and Esc keys, and the kind of feedback you like on a desktop machine. Feedback is very subjective, but most people prefer a solid keyboard feel with tactile feedback. Not all laptops fit the bill.

Like many portables, the Data General One/Model 2T has a keyboard with an embedded numeric pad and scrolling keys. Forcing keys to do double duty is one size/functionality tradeoff of laptops.

The Bondwell 8 is the most compact laptop in the group we reviewed, but one result of its diminutive size is that its keyboard is simply too small to be used comfortably.

The Datavue Spark's keyboard has a surprisingly solid feel. It's as good as the NEC MultiSpeed's or the Zenith Z-183's, and that indicates the kind of bargain that the Spark is.

What a pleasure to be on the road and have a full-size AT-style keyboard. It doesn't feel quite as solid as the average desktop's, but the Compaq Portable III's keyboard reminds you of home.

You'll notice some strange key placements on the GRiDLite's keyboard (try to find the Del or apostrophe key), and the overall feel is crowded. Of course, like the machine itself, it sure looks good.

Photographs: Thom O'Connor

The winner of the laptop keyboard competition remains the IBM PC Convertible. It feels, saunds, and looks just right with excellent audible and tactile feedback.

Despite the small footprint of the Tashiba T1100 Plus, its keyboard has 81 keys, and only a few have to perfarm dauble duty. It's a major factor in the T1100 Plus's Editor's Chaice award.

What's different about this picture? The NEC MultiSpeed positions its function keys down the left-hand side of the keyboard. Users accustomed to the classic XT keyboard will be thankful for this design.

The Wang LapTop's keyboard has a good feel, but its layout will seem foreign to users uccustomed to PC-compatible designs. There are several extra keys, many of which you may never have heard of before.

The Sharp PC-7100's keyboard looks but doesn't feel quite solid enough. Like the Compaq's, it's full-desktop-size, a virtue appreciated by those who must use a more-cramped laptop keyboard.

The Zenith Z-183's keyboard is an improvement over its predecessor. The weird key placements of the past have all been fixed. The keyboard also features shift-state LEDs in this revision.

TOSHIBA AMERICA INC.

Toshiba T1100 Plus

If portable PCs were eligible for the Olympics, Toshiba America Inc.'s Toshiba T1100 Plus would be entered in the decathlon. And favored to be a medalist. While the Toshiba would be an unlikely victor in any single area that calls for ultimate quickness or strength, nothing else manages the T1100 Plus's all-round brilliance.

In a world where the corporate PC budget is bottomless, you'd have a Compaq Portable III for heavy-duty number-crunching in hotel rooms, a Zenith Z-181 for 90-minute stints of word processing on dimly lit planes, and a Tandy 102 for silent note-taking in an auditorium lacking ready access to 110 volts.

In the real world, you're lucky to have your own desktop PC and one DOS-to-travel machine. If you have to choose one portable with the most virtues and fewest drawbacks, you're going to choose the T1100 Plus.

The $2,099 Toshiba ranks among the very lightest (10 pounds by itself, 13 pounds with the charger, internal modem and nylon carrying case) and most compact (12 by 12 by 2⅝ inches). The 80C86 (8086 CMOS) processor runs at 4.77 MHz or 7.16 MHz, faster than almost all of the 8088-genre laptops save the NEC MultiSpeed. All the I/O you could possibly want is built in: two microfloppies, parallel and serial ports, room for a $399 modem, and RGB and composite monitor outputs. The printer port can also be used to drive a $499 external Toshiba 5¼-inch floppy disk, the floppy drives of a desktop PC via Toshiba's $199 Floppy Link, or an overpriced ($999) five-slot expansion box. For that kind of money you could buy a whole PC.

Despite its small footprint, Toshiba packs in 81 keys. The ten function keys are across the top. The eight page-movement keys (the four cursor keys and PgUp, PgDn, Home, and End) are all there, unlike in the Zenith, which makes four keys do double duty. The right side of the alpha keys can be switched to a numeric keypad, thereby extending the keyboard's utility further.

The supertwist LCD screen, upgraded late this winter, ranks among the better nonilluminated displays. Only the GRiD LCD is markedly bigger and better; the NEC display is about the same, though its bigger display panel gives NEC a slight edge. Everything else ranks lower, including IBM's improved supertwist LCD. None of these reflective LCDs can hold a candle to the Zenith or Wang backlit screens, of course—but that's your tradeoff with battery life.

Toshiba was the first company with a serious all-purpose laptop in early 1986 (serious defined as not overpriced and not overweight—sorry, GRiD; sorry, Data General).

The original T1100 keyboard was bizarre, the screen was poor by today's standards, the modem reached only 300 bits per second, the serial port was an option, and there was no second disk drive and no carrying handle. But it was the be-

The Toshiba T1100 Plus is a former Editor's Choice and it wins a mention a second time for its slender design, improved supertwist LCD screen (only the GRiDLite's is better), and 8086 speed. Toshiba owners also have the advantage of a large third-party peripherals market to shop in.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Toshiba T1100 Plus
Toshiba America Inc.
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680
(714) 730-5000

List Price: With 640K RAM, two 3½-inch floppy disk drives, MS-DOS 3.2, carrying case, *SideKick*, $2,099; 1,200-bps modem, $399; power supply, $499; *Floppy Link* (controls desktop PC 5¼-inch drives), $199; car battery adapter/charger, $39; five-slot expansion chassis, $999; interface card, $199; screen upgrade for early T1100 Plus, $275 (call (714) 632-3504, ext. 95).

In Short: The all-round choice for best combination of slender design, speed, battery life and screen (LCD) legibility. The screen could use a few more square inches.

CIRCLE **665** ON READER SERVICE CARD

COUNTERPOINTS

Light, nice keyboard, decent price. But the drab display puts me to sleep. **—Mitt Jones**

A good choice for all-around efficiency, but it's a little, um, boring. It's no GRiDlite.**—Nora Georgas**

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CIRCLE 196 ON READER SERVICE CARD

UPGRADING YOUR TOSHIBA T1100 PLUS

Premier Technologies and Axonix can both fit your Toshiba T1100 Plus with a hard disk drive.

Since its introduction, the Toshiba T1100 Plus has been one of the most successful competitors in the laptop market. In the eyes of its boosters, the T1100 Plus has everything, but as technology marches forward, even the most devoted fan must have mused wistfully, "Wouldn't it be great if I could get a hard disk into this machine?"

Engineers at Premier Technologies of Irvine, California, and Axonix Corp. of Salt Lake City, Utah, were wondering the same thing, and they've done something about it.

For $995, Premier Technologies can fit your T1100 Plus with a 10-megabyte hard disk drive that adds only 6 ounces to the laptop's weight.

The LiteDrive, based on the same model used in the Toshiba T3100, can be field-installed in about 15 minutes by selected dealers representing Premier Technologies. The lower floppy disk drive is removed and the hard disk inserted in its place.

The LiteDrive's power consumption is kept to a minimum by a power-down feature that shuts the drive off at user-defined intervals. The drive springs back to life within four seconds when accessed by any read or write command.

Even with constant reading and writing, the LiteDrive can operate off the battery for 3 hours and 55 minutes. Reading or writing only once a minute will extend the life of the battery to 6½ hours.

Premier Technologies first introduced retrofitted hard disk drives on the Zenith Z-171 last August. The LiteDrive for the Toshiba T1100 Plus was their second offering, and a hard disk drive for the NEC MultiSpeed, also priced at $995, was announced in May.

For more information, contact Premier Technologies, 1890 McGaw Ave.; Irvine, CA 92714; (714) 261-1184.

Axonix offers two expansion kits for the T1100 Plus. The first, called the ThinWin, is installed in the laptop's B: drive just like Premier's LiteDrive. It is available in 10- and 20-megabyte capacities ($995 and $1,295) and is retrofitted by Axonix or an authorized dealer.

Axonix's second expansion option, the ThinPack 1100, is a user-installable external expansion chassis that contains a hard disk, a rechargeable battery, and two expansion slots that will accommodate PC-compatible half-cards. The 10-megabyte version costs $1,195; the 20-megabyte version, $1,395. The entire package weighs 4½ pounds and adds 1½ inches to the thickness of the T1100 Plus.

For more information, contact Axonix Corp., 2257 S. 1100 East, #2C, Salt Lake City, UT 84106; (801) 466-9797.—**Donald P. Willmott**

Donald P. Willmott is an assistant editor at PC Magazine.

ginning of an excellent evolution.

By the middle of last year, Toshiba had fixed everything that was wrong or underwhelming with the T1100. With the new supertwist screen and a $300 price cut, the current model improves on the original T1100 Plus, which won last year's PC Magazine Award for Technical Excellence and was elected an Editor's Choice (Volume 5 Number 22). Owners of the original T1100 Plus, but not the T1100, can upgrade to the current supertwist LCD screen for $275. The improvement is marginal but noticeable. Is it worth the extra money? If your company is paying, definitely yes; if it's coming out of your own pocket, it's still worthwhile. Call Toshiba at (714) 632-3504, ext. 95, for details.

Products that stand still make good targets. If Toshiba wants to maintain the T1100's leadership, it should consider an internal hard disk option, a slightly bigger screen, a backlit screen option, a removable nickel cadmium battery, a 2,400-bps modem, battery-backed RAM, a better carrying case (the two pouches for one floppy disk each are most insecure, and there's little room to let you carry along paperwork), a condensed traveling-user manual to supplement the 2.2-pound desktop reference set, and a lighter external 5¼-inch disk (the beast weighs 8 pounds with power supply).

The speaker whistles for 3 seconds if you shut the top with the power on. Normally that's an advantage, but there are times when you wish you could close the lid without annoying others around you.

Otherwise, it's just fine. Toshiba jumped out front early, and while the competition is getting better, no one else has yet managed an all-round winner on a par with the T1100 Plus.—**Bill Howard**

WANG LABORATORIES INC.

Wang LapTop

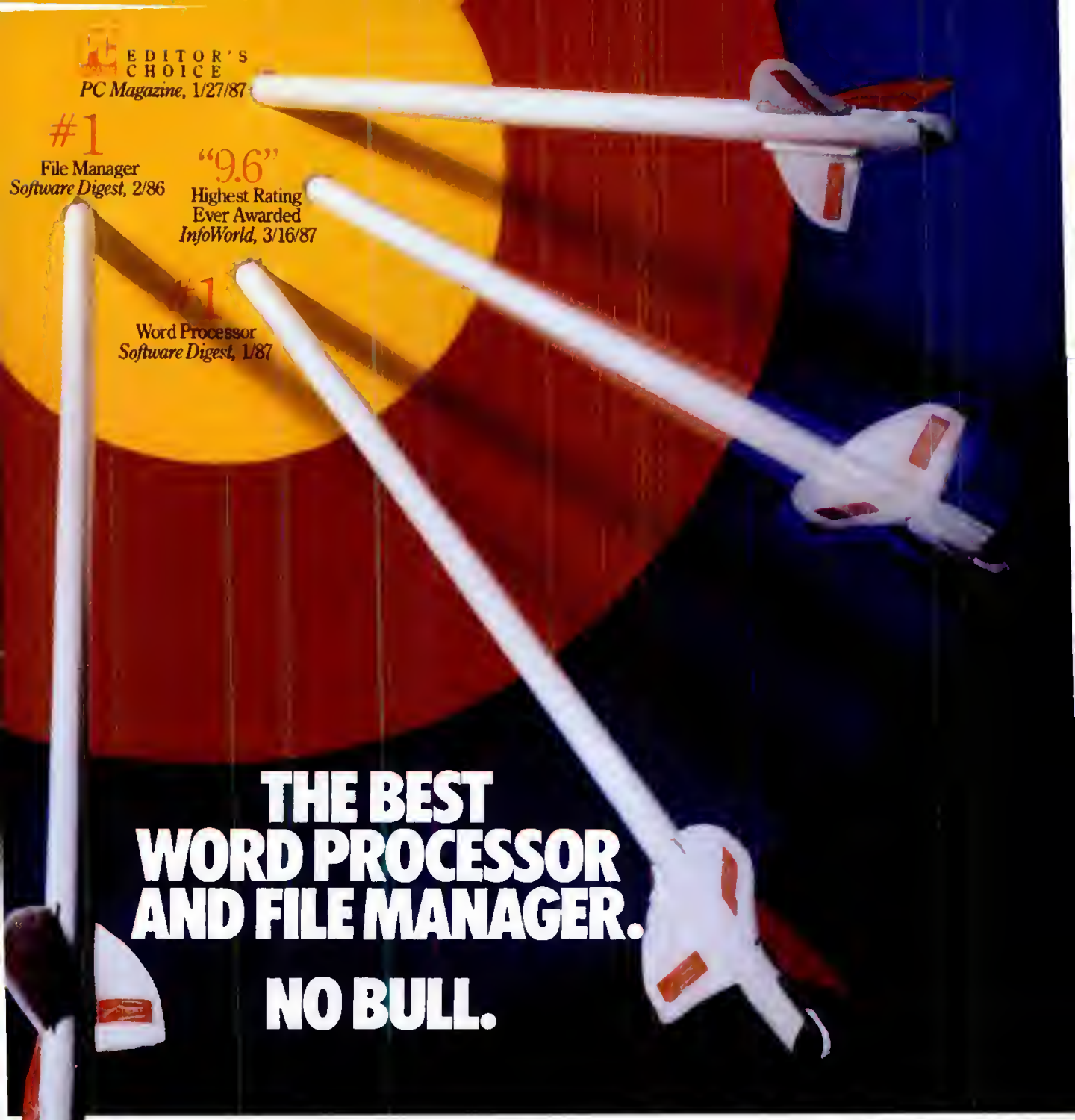
Wang Laboratories Inc. managed to turn a nice idea—an 8-MHz laptop with an internal hard disk, a supertwist LCD, and a built-in thermal printer—into a product that's simply too bothersome for use as a PC-compatible machine.

Among my more serious gripes with the machine is its lack of an internal diskette drive: for $3,530 you get a 10 megabyte hard disk, a built-in printer, and a nickel cadmium battery pack, but no diskette drives.

The "optional" external drives will cost you $365 for a 5¼-inch and/or $518 for a 3½-inch. The drives are rather bulky, so you probably won't want to take them with you when you travel. But, then again, the laptop is a bit large as well, though it's difficult to imagine such a feature-laden laptop being much smaller or lighter.

My other major complaints with the machine center around its "Wangness." For people who use Wangs, this laptop may be a dream come true, but its true-to-Wang design poses problems for the PC-compatible user.

Apart from a rather strange keyboard



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CIRCLE 251 ON READER SERVICE CARD

You can't help but notice the thermal printer sitting in the middle of the Wang LapTop. Its weight and the weight of the standard hard disk make this a bulky package. The Wang LapTop is the least PC compatible of the laptops reviewed here, but Wang users will find it familiar.

layout, Wang systems use a bus, character set, and display standard that are foreign to PC-compatible machines. To give Wang users what they're accustomed to and provide MS-DOS compatibility too, Wang fitted the LapTop with a layer of disk-based software to handle MS-DOS applications.

You switch between three system modes: Wang, Industry Standard Monochrome (MS-DOS and IBM MDA standard display), and Industry Standard Color (MS-DOS and IBM CGA standard display), depending on your application. Choosing an industry-standard mode activates the ASCII character set and switches to an IBM-standard display mode.

Since Wang uses a SCSI bus, the LapTop must translate PC ROM BIOS calls in order to run MS-DOS applications. This means you must copy six files, including the BIOS.SYS file that handles the translation, to every disk you want to be able to boot from.

This translation slows operation considerably. The Wang's 8-MHz processor fared well in PC Labs tests, but display speeds and disk accesses were extremely slow, with the exception of display writes directly to display memory, which bypass PC ROM BIOS. The Wang hard disk couldn't run the test that uses BIOS interrupt 13h, but this shouldn't cause problems with applications programs.

Despite the oddity of Wang's compatibility scheme, most DOS applications I tried worked—including *WordStar 2000 Plus* , *WordPerfect* 4.2, *SideKick*, a late version of Lotus's *1-2-3*, Release 1A, and *Xywrite II Plus*. Some programs took a bit of trial-and-error experimentation, however. *SideKick* wouldn't run properly until I changed the screen driver from the default. Version 3.1 of *The Norton Utilities* detected the Wang display and set itself accordingly, so it ran properly in Wang mode but not in the IBM-compatible modes. I could get neither of two chess programs to run, probably because of their copy-protection schemes.

The LapTop's built-in thermal printer is perhaps its most impressive feature, though I would gladly give it up for an internal disk drive. Rated at 18 characters per second, the Epson MX-80–compatible printer supports direct printing on thermal paper or transfer printing using a ribbon cartridge. The printer produces surprisingly nice near-letter-quality print, and a paper-roll attachment is a real plus.

Besides the external disk drives, Wang offers several other optional features. You can add an internal Hayes-compatible modem and an additional 512K bytes of RAM in the LapTop's two proprietary slots, though Wang supports only 640K RAM.

A built-in serial port lets you add an external modem, and Wang supplies an optional serial-to-parallel converter for an external parallel printer.

■ The Wang LapTop's built-in printer supports direct printing on thermal paper or transfer printing using a ribbon cartridge.

PC MAGAZINE FACT FILE

Wang LapTop
Wang Laboratories Inc.
One Industrial Ave.
Lowell, MA 01851
(617) 459-5000
List Price: With 512K RAM, 10-Mbyte hard disk, thermal printer, battery, DOS 3.2, and carrying case, $3,530; additional 512K RAM, $695; 3½-inch external disk drive, $518; 5¼-inch floppy disk drive, $365; *Wang Word Processor*, $195; communications software, $100; 1,200-bps modem, $425; 2,400-bps modem, $795.
In Short: The Wang LapTop tries to please both the Wang-compatible market and the PC-compatible market, and the tightrope act that it performs isn't successful enough to please either camp.

CIRCLE **664** ON READER SERVICE CARD

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The Source	X	X	X	X	X	X	$49.95	$10.00	$8.40	$10.80
CompuServe	X	X	X	X	X	X	$39.95	none	$6.00	$12.50
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CIRCLE 247 ON READER SERVICE CARD

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The LapTop also has a monitor port, but you'll need a proprietary cable and a 25-KHz monitor (Wang recommends a multiscanning monitor) to set up an external color display.

Wang users will appreciate the Wang user software shell included in the LapTop's base price. The shell includes system utilities, an editor, and communications options. You can disable the shell easily once you're up and running.

The LapTop's documentation is loaded with information but is probably the most poorly organized collection of manuals I've ever seen. Information on any given topic seems to be spread strategically throughout the four binders. I searched for the paper-roll mounting instructions in the installation guide, user guide, and printer software manual before finally finding them in the fundamentals guide.

I liked the Wang's keyboard feel, found the surpertwist LCD more than adequate, and enjoyed the luxury of a 10-megabyte hard disk in a laptop. But Wang's efforts to please both Wang users and PC-compatible users caused more annoyance than my tolerance level could take. Unless you're a Wang user, you're better off with a machine that doesn't have to work so hard for compatibility.—**Mitt Jones**

An Editor's Choice award goes to the Zenith Z-183 Portable PC. Its screen is more dazzling than ever, a standard to which all other manufacturers are still striving. With the addition of a hard disk drive, this portable has become the best battery-powered choice for the desktop.

ZENITH DATA SYSTEMS

Zenith Z-183 Portable PC

First the bad news. Don't buy that Yugo! If you want the most computer power in the sleekest possible box, take your four thousand bucks, march to your computer dealer, and plunk it down for Zenith Data System's Zenith Z-183 Portable PC.

What a world, when a good knee-hugging computer costs as much as a small knee-hugging car. But that's because the Z-183 is simply the best portable in the market, bar none. It's just too bad you have to be as fully loaded as the computer to afford it. And some of our scrawnier testers complained that the label on the side ought to say Jack La Lanne rather than Zenith.

There wasn't too much seriously wrong with Zenith's earlier Z-181. It lacked a handle and a discrete numeric keypad. The cursor pad was at the top of the keyboard rather than the bottom, the CapsLock key had migrated into the wrong territory, Ins and Del shared the same key, and the Enter key was small and sort of gallows-shaped. You weren't able to configure the serial port the way you wanted. The innards chugged along at a sleepy 4.77 MHz, and you couldn't leave it plugged in for more than 12 hours without turning the battery pack into a puddle. But the superb, shocking-blue, true-aspect screen made up for it all, and put the competition to shame (it still does).

The good news is that Zenith has fixed every one of those quirks, and tossed in a 10-megabyte hard disk besides. The new machine now sprints along at 8 MHz (though a DIP switch on the bottom lets you choke it down to a PC crawl). Its handle is unobtrusive, balanced, and solid. The floppy disk drive still loads from the top, a genuine and underrated plus. You can plug an optional numeric keypad (or a whole PC keyboard) into a new keyboard port. And it sports a gorgeous remodeled Selectric keyboard, with new shift-state LEDs (but it skimps on button-like top-row special-purpose keys).

Z-181 GETS IMPROVEMENTS

If you're not ready for the power—or the price tag—of the Zenith Z-183, you can buy an updated version of the original Z-181. The new Z-181 costs the same as the old one—$2,399—and has the same 80C88 processor. But it also has the dazzling screen featured on the Z-183, improved battery life, and a hard disk interface. (Zenith will sell a 20-megabyte hard disk for $1,299.)
—**Nora Georgas**

Okay, okay, nobody's perfect. The designer who turned the Z-183 keyboard into a thing of beauty obviously doesn't use function keys on a daily basis. The hard disk could be speedier (at 110 milliseconds, it's still far faster than the To-

MEMO

TO: J. Greaney
FROM: J. L. Sanders
RE: Our "Ideal" Laptop

Jack, we need a laptop that doesn't compromise on performance. Include as many of these key features as possible. — J.L.

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CIRCLE 190 ON READER SERVICE CARD

STILL IN THE RUNNING

While the laptop computers in this roundup represent the newest arrivals and the newest upgrades, several models that *PC Magazine* has reviewed in the past are still on the market and selling well. Last December, *PC Magazine* evaluated seven laptops (see "DOS Travels Better Now: What's New in Portables," *PC Magazine*, Volume 5 Number 22). Reviews of three computers that have not been significantly upgraded since then are summarized here.

GRID SYSTEMS CORP.

GRiDCase 3 Plus

The best word to describe GRiD Systems Corp.'s GRiDCase 3 Plus is "high": high style, high engineering, high speed, and high price. Its sleek black magnesium case frames a brilliant orange plasma display and an optional 10-megabyte hard disk that will run off a battery, but all that power will cost you over $4,000.

With a hard disk drive and a plasma display, the GRiDCase 3 Plus costs over $4,000.

Bucking conventional wisdom, the designers of the GRiDCase 3 Plus chose to save weight by including no floppy disk drive in models that carry the hard disk. Their reasoning is that people in the field can put whatever they need on the hard disk by hooking up the external GRiD pocket floppy drive ($295) before they leave the office. You can purchase ROM software from GRiD, or they will burn in your own software for you.

PC MAGAZINE FACT FILE

GRiDCase 3 Plus
GRiD Systems Corp.
2535 Garcia Ave.
P.O. Box 7535
Mountain View, CA 94039
(415) 961-4800
List Price: GRiDCase 3 Plus with gas display, $3,280; GRiDCase 2 Plus with yellow LCD, 128K RAM, parallel/serial port, internal 3½-inch floppy disk drive, $2,750; external 5¼-inch floppy drive, $875; 3½-inch pocket floppy disk drive, $295; RGB connector, $295; expansion bus, $325; internal 300/1,200-bps modem, $495; 8087 processor, $195; 384K RAM, $400; 512K RAM, $600; internal 10-Mbyte hard disk, $975; MS-DOS 3.2 and InteGRiD interface system, $150.
In Short: A unique, highly designed machine that is constructed to the highest standards with the best materials. Incredibly rugged and well made, with many innovative design ideas.
CIRCLE 676 ON READER SERVICE CARD

The plasma display is in a class by itself. The only close competition is from the Toshiba T3100, but the GRiD's orange-on-black display is easier to read than the Toshiba's orange-on-lighter-orange field.

For $530 less, you can get the GRiDCase 2 Plus, the same machine with a high-quality LCD screen in place of the plasma display. This configuration extends battery life; another way to accomplish the same end is with optional battery packs (about $60).

The GRiDCase 3 Plus's keyboard is a vast improvement over earlier incarnations. It is quiet and silky-smooth, with good tactile feedback. There are only 71 keys, but they can generate all the IBM keys.

With the hard disk, performance times are good but not as good as those from the NEC MultiSpeed, with its 9.54-MHz clock speed. Nevertheless, the GRiDCase 3 Plus is a snazzy, good-looking laptop.

HEWLETT-PACKARD CO.

HP Portable Plus

The first thing you'll notice about Hewlett-Packard's HP Portable Plus is that unlike just about every laptop in existence (Tandy's excluded), it has no disk drives. In fact, the only way you can use a disk drive with the Portable Plus is to hook up the optional 3½-inch disk external unit.

HP has put a premium on portability, durability, and convenience, and by those standards, leaving out a disk drive may make some sense. In place of a conventional disk drive, there's an electronic disk and room for a fair amount of ROM software. The result is a portable that's swift, rugged, and fairly easy to use.

In its own quirky way, the Portable Plus is a good performer. The screen is quite legible even though it is not backlit, and performance times are good. However, the keyboard, which has only eight function keys and no PgUp, PgDn, End, or Home keys, compromises too much and has a feel that is toylike at best.

■ The best word to describe GRiD Systems' GRiDCase 3 Plus is "high": high style, high engineering, high speed, and high price.

Another anomaly is the fact that the Portable Plus has an RS-232 port, but it comes with the HP-IL, a proprietary interface link for connecting HP peripherals. The special interface card you'll need to hook up with non-HP equipment will increase the price of working with this machine.

Photographs: Thom O'Connor

The Hewlett-Packard Portable Plus is a diskless laptop with a large amount of ROM.

The Portable Plus comes with DOS 2.11, a DOS shell called PAM, and diagnostics. Popular programs are available from HP in ROM versions. Disk-based software can be downloaded to the electronic disk with the external disk drive.

At $2,995, the HP Portable Plus is no bargain, especially when you consider that this is a diskless laptop. This peculiarity makes it an outsider in today's market. Despite excellent battery life (claimed to be at 20 hours), the inconvenience of having no disk drives outweighs the speed and engineering benefits.

PC MAGAZINE FACT FILE

HP Portable Plus
Hewlett-Packard Co.
1000 NE Circle Blvd.
Corvallis, OR 97330
(800) FOR-HPPC
List Price: $2,995; 1-Mbyte RAM drawer, $1,695; external 3½-inch floppy disk drive, $795; model with internal modem (300/1,200 bps), $3,490.
In Short: The HP Portable Plus, which comes without disk drives, is more of a notebook machine than a portable PC. Its display is quite good, but compromises, especially in the keyboard, detract from its overall performance.

CIRCLE **675** ON READER SERVICE CARD

TOSHIBA AMERICA INC.

Toshiba T3100

Toshiba America's Toshiba T3100, with its 80286 processor, internal 10-megabyte hard disk, microfloppy disk drive, and plasma display, is a true AT-class portable and a winner of *PC Magazine*'s Award for Technical Excellence. Weighing in at 15 pounds, the T3100 offers more power per pound than any other portable computer.

The keyboard is full-featured and has a responsive feel. It is identical to the keyboard of the T1100 Plus, with its function keys arrayed across the top.

The gas-plasma display, measuring a bit shy of 8 by 6 inches, is a real beauty and will mesmerize you. Some LCD fans will argue that a backlit screen is too power hungry, but assuming that buyers of the T3100 are prepared to find an AC outlet anyway, this should not be a real concern.

Two weak points of the T3100, lack of a battery power supply and slow hard disk access time, have been addressed by outside vendors. Product R&D Corp. is now marketing the AdaptaPak, a rechargeable, portable battery pack that will run the T3100 for about 1 hour and 15 minutes. The product also comes with an adapter that allows you to plug the laptop into a car's cigarette lighter. The AdaptaPak, which also works with the Sharp PC 7100 laptop, weighs 7 pounds and costs $399. The battery adapter sells alone for $299. Contact Product R&D Corp., 1194 Pacific St., #201, San Luis Obispo, CA 93401; (805) 546-9713.

Several companies, led by Axonix Corp., are developing retrofitted hard disks for the T3100 that perform far better than Toshiba's own (see "Upgrading Your Toshiba T1100 Plus").

In addition, Holmes Microsystems has begun shipping an internal 1,200-bit-per-second Hayes-compatible modem for the T1100 Plus and the T3100 that sells for $339, $60 cheaper than Toshiba's own optional modem. Contact Holmes Microsystems, 7050 Union Park Center, #610, Midvale, UT 84047; (801) 572-6865.

Toshiba's T3100 is a winner of PC Magazine*'s Award for Technical Excellence.*

The T3100 now retails for $4,199; a $300 price cut went into effect in late February. It is still a very expensive unit, but if you need true power on the road, get the T3100. It's the most compact and most powerful AT-class machine you can sling on your shoulder.

—Donald P. Willmott

PC MAGAZINE FACT FILE

Toshiba T3100
Toshiba America Inc.
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680
(714) 730-5000
List Price: With 640K RAM, 10-Mbyte hard disk, 3½-inch floppy disk drive, parallel/serial and RGB ports, clock/calendar, and case, $4,199; internal 300/1,200-bps modem, $399; external 5½-inch floppy drive, $499; PC Floppy Link, $199; expansion chassis and cable with five slots, $999; expansion interface card, $199; numeric keypad, $99.
Requires: AC outlet.
In Short: Simply the best AT-compatible portable on the market today. It may be a bit pricey, but in this case you certainly get what you pay for.

CIRCLE **674** ON READER SERVICE CARD

PC MAGAZINE EDITOR'S CHOICE

- **NEC MultiSpeed**
- **Toshiba T1100 Plus**
- **Zenith Z-183 Portable PC**

When PC Magazine *first looked at laptop and DOS-to-travel machines a year ago, the choice was* None of Them. *The quality of the offerings has improved so dramatically that our choice now could be* Almost All of Them.

The best of the best laptops? PC Magazine *found three:*

The Toshiba T1100 Plus remains the best all-round combination of power, compact portability, and features. The screen is slightly improved and the price is $300 less than the Editor's Choice T1100 Plus of 6 months ago.

The Zenith Z-183 Portable PC retains the dazzling backlit blue screen of the Z-181, adds a 10-megabyte hard disk, improved keyboard, faster 8-MHz CPU, and a handle. It's not cheap ($3,399) or light (15.4 pounds), but if any battery-powered laptop could replace a desktop PC, the Z-183 is it.

The NEC MultiSpeed, with its CMOS V30 chip, is the fastest of the 8088/8086-type machines at 9.54 MHz; and it's priced right at $1,995, especially with the new backlit screen. But it's bulkier than the T1100 Plus.

Finally, if you've heard of the Datavue Spark but just don't believe that a $995 laptop can be a serious machine, look again. This is a well-built, speedy (the NEC MultiSpeed is the only other machine that has 9.54-MHz clock speed like the Spark), and full-featured. It's almost in the same class as our three winners, and a lot cheaper than any of them.

If battery operation isn't essential, three AC-only machines deserve a mention: The Compaq Portable III puts incredible speed (a 12- MHz 80286) and a fast 20-megabyte hard disk plus a 5¼-inch floppy disk drive in a 20-pound lunchbox. The 8-MHz AT-class Toshiba T3100 laptop is 6 pounds lighter and far sleeker, but the 10-megabyte hard disk is a slug. While Sharp's PC-7100 is an unremarkable XT-class lunchbox machine, the 5¼-inch floppy disk may be reassuring to those who aren't ready to take the plunge into the 3½-inch disk world.

shiba T3100's). And the chassis is noticeably larger—3 percent wider, 14 percent longer, about 12 percent fatter—and over 4 pounds heavier.

One reason for the weight is that the whole works are sheathed in a double-thick lexan shell so sturdy it has Zenith technicians grumbling. Road machines take a real beating, especially when drop-kicked by airline baggage subcreatures. When service departments at other manufacturers receive a box full of pea-sized shrapnel, they know the user is at fault. But Zenith cases have a habit of surviving high-G stress, which lets clumsy owners return bounced machines with innocent notes claiming that the solder traces tore free from the motherboards all by themselves.

A standard 640K machine with one 3½-inch 720K floppy, a 10-megabyte hard disk, DOS 3.2, a keyboard-switchable RGB interface, battery-backed-up clock, 9-pin serial and 25-pin parallel ports, DIN connector for an external keyboard or numeric keypad, and external floppy/barcode reader port goes for a pricey $3,399.

You'll probably want to slide in a 1,200-bit-per-second modem ($399) and drop the whole thing into a durable black American Tourister travel case ($69), which comes with a pocket that holds a tiny Diconix-sized printer. Serious players can order an optional 8087 math chip and a megabyte of EMS memory—and both a 20-megabyte drive and 2,400-bps modem are "just around the corner."

Since the hard disk and backlit supertwist screen are ravenous power pigs, Zenith shuts down just about everything under the hood unless it's being used. The screen goes dim after 2 minutes (though you can now customize the interval). The floppy disk controller, serial, parallel, and RGB ports, modem, and hard disk controller (but not the hard disk platters themselves) cycle down when not in use. Factory-supplied C cells will keep the CPU humming for 2½ hours; by upgrading to optional D-sized nickel cadmium batteries, you can nurse the system along for up to 4 hours. And the new thumbscrews mean you no longer need a screwdriver to change the battery.

Special key combinations can cycle through the range of gray-scale palettes, toggle the key click, jump the system into one of two "smart" keyboard modes that give you precise control over the cursor control keys, and bring up the diagnostic/debug/video fine-tuning firmware. Also, a dozen on-disk utilities furnish communications, partitioning, configuration, file and memory tools.

However, at nearly 16 pounds, the Z-183 is a real armful. Moreover, to pre-

COUNTERPOINTS

A few pounds overweight. But what a screen!—**Mitt Jones**

Nearly a year after its introduction, the Zenith screen still has an overwhelming impact. I wouldn't want to carry one for very long, but I find it easier on the eyes than an EGA.—**Gus Venditto**

I didn't like the hinge position on the 181 because the screen hits the seat in front of you on every kind of public transportation. The larger 183 is even worse. With the clock speed, hard disk, and the full-sized screen, though, this is a great machine for the field.
—**Bill Machrone**

All the great new features upgrade the already lap-hogging Zenith 181 from laptop to luggable. Thanks but no thanks.—**Paul Stafford**

Great machine, if you can hire a bearer to carry it for you.—**Nora Georgas**

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■ LAPTOPS

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Zenith Z-183 Portable PC
Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8949

List Price: With 640K RAM, one top-mounted retractable 3½-inch floppy disk drive, one 10-Mbyte hard disk drive, clock/calendar, firmware diagnostics and debugger, external drive connector, MS-DOS 3.2, $3,339; 300/1,200-bps modem, $399; carrying case, $69; external 5¼-inch floppy disk drive, $399; extra C-cell battery pack, $99; external battery pack recharger, $29; automobile cigarette-lighter power adapter, $19; PC XFER null modem and software, $99; 1-Mbyte EMS memory, 8087 math co-processor, external numeric keypad, call manufacturer for pricing.

In Short: Heavy and expensive for a laptop, but if you have big arms and a big bankroll, simply the best machine available. Boasts the now-famous awesome, full-sized, drop-dead backlit supertwist screen that users love and competitors hate, and a decent battery-powered hard disk. The much-improved keyboard could still stand better non-alpha-numeric keys. But overall a superb, sleek powerhouse of a portable computer.

CIRCLE **663** ON READER SERVICE CARD

vent battery drain, it should beep when you lower the cover without first hitting the off switch. While the 78-key keyboard earns generally high marks, you should be able to hit PgUp, PgDn, Home, and End without having to lean on the Fn shift key, and the function keys could be better. Still, the screen remains the best of breed by a large margin, and the welter of hot new features makes it an even more extraordinary machine.

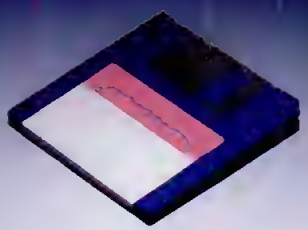
Sure, Toshiba's T1100 Plus is a lighter little package to schlep through airports. The NEC MultiSpeed can churn data a bit faster and has a whale of keyboard. And Bill Machrone's never going to trade in his travel-worn Tandy Model 100 until some manufacturer produces a 5-pound notebook-sized DOS machine with decent speed and storage.

But the Z-183 gets my vote as the Laptop leader. Zenith should have added a 79th key. Press it and the screen would fill with synonyms for "dazzling."

—Paul Somerson

The inventors of the 3.5" drive recommend only one floppy disk.

Theirs.



If your computer has 3.5" drives, it has a little bit of Sony. Because Sony invented the 3.5" drive technology that has taken floppy disk memory all the way to two megabytes.

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System Two

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Full-Page High-Resolution WYSIWYG Monitor (736 x 1008 pixels). This powerful full-page (portrait-screen) displays text and graphics at 100 dots per inch resolution. Special video adapter with parallel printer port is included.

Formatted 40MB MiniScribe fixed disk drive. Provides high-speed (28ms) disk accessing for superior performance.

Second-Generation Hewlett-Packard LaserJet Series II laser printer with cable and 512KB print buffer (expandable to 4.5MB). The versatile 8-page-per-minute Series II prints a range of page sizes.

Microsoft Windows. A multi-tasking, DOS-enhancing enviroment. Windows includes a word processing program, a paint program, communications manager, alarm clock, calendar, memory manager, card filer, and task switching program.

Aldus PageMaker, the program that started the desktop publishing revolution. Build graphic elements, create or change fill patterns, line widths, type styles and sizes, and wrap text around graphic objects. Create and store formats for newsletters, textbooks, ads, or other documents.

$5995

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You don't have to be a desktop publishing expert to get started with your WYSIWYG system. Each system comes fully pre-configured — all you have to do is plug in the cables using the step-by-step installation booklet, and you're ready to start creating.

Options

Hewlett Packard ScanJet Scanner. This flatbed desktop scanner enables you to add existing drawings, logos, photographs, or other graphic images to your desktop applications. Scanjet offers exposure, scaling, and resolution controls. An optional 20-page document feeder is available.

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Ventura Publisher Software, part of the Xerox Desktop Publishing Series, is one of the best desktop publishing programs available for PC- and AT-class machines. Ventura integrates text and graphics from numerous word processing, graphics, and spreadsheet programs. A wide selection of predesigned layouts is included or create your own.

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2-MB LaserJet Series II Expansion Memory	$695
Font Cartridge for the LaserJet Series II	$185
Microsoft Word Version 3.2	$275

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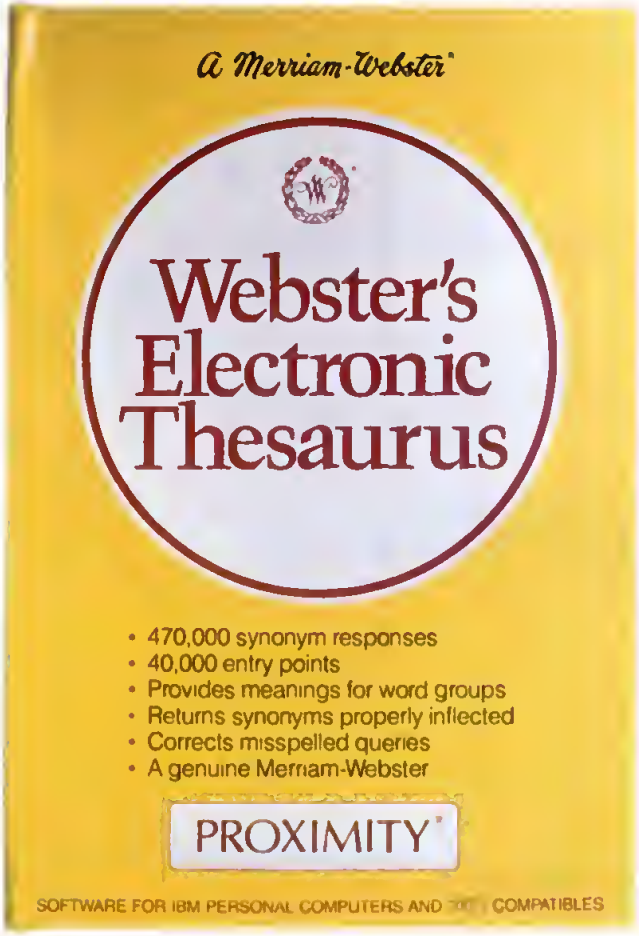
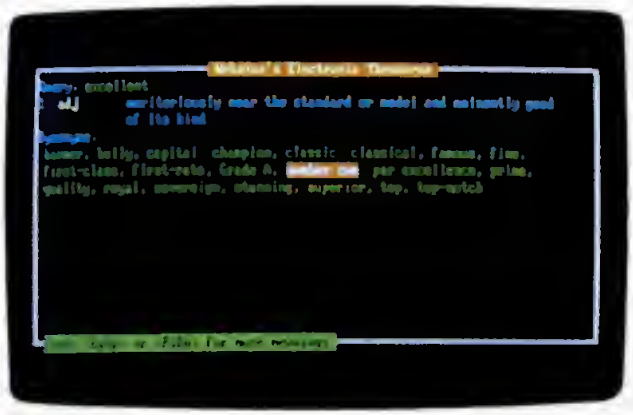


The editors at Merriam-Webster understand that to choose a word wisely, you need to *know* the meaning. That's why, (unlike others) *Webster's Electronic Thesaurus* helps you find a good word that *means* what you want to say.

Webster's Electronic Thesaurus is easy to use—just put the cursor on the word you want to replace and pop-up the program. The screen first shows you a list of meanings for the word—choose one and a keystroke later you have its synonyms.

Webster's Electronic Thesaurus offers a list of correct spellings to choose from if your lookup word is misspelled—properly inflects the synonyms if your word is past tense, plural, etc.—allows you to cross-reference synonyms—and lets you "bring back" your synonym without deleting or retyping!



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WAY WITH WORDS

Mark Twain once said that the difference between the almost-right word and the right word is the difference between a lightning bug and lightning. If you agree with Twain that finding the right word can be important to your writing, you probably know how valuable a thesaurus is—and also how tiresome it can be to use one.

I was thinking about the tedium of working with a printed thesaurus two years ago when I first tried *Synonym Finder*, an electronic thesaurus from Writing Consultants. I could imagine how marvelous it would be to see a display of synonyms on the computer screen while I was in a word processing program. I was enthusiastic because I had it on good authority that *Synonym Finder* was the state of the art in electronic thesaurus programs. I decided to start looking for someone who could provide a home for my aging desk thesaurus.

After working for a bit with *Synonym Finder*, it dawned on me that ox-carts must once

have been the state of the art in over-the-ground transportation systems. *Synonym Finder* was fussy about which word processors it could live with. It was stingy about summoning up more than a very anemic list of synonyms. Worst of all, it wasn't clever enough to recognize simple words like *plow* and *lock* (or *synonym* and *finder*, for that matter). I decided to keep my desk thesaurus and find a new home for *Synonym Finder*.

THE NEW PROGRAMS Two years can bring many changes, especially in the computer world. During that time—in a persuasive demonstration of its own commitment to finding the right word—Writing Consultants became Microlytics, and its product, *Synonym Finder*, was renamed *Word Finder*. The improvements that came with the new names were no less dramatic.

Word Finder still can't compete with a printed thesaurus, but it makes up for this by being so convenient. The same is true of a number of other electronic thesaurus programs. The key issue is no longer whether to get an electronic thesaurus, but which one to choose.

The programs reviewed here, *Webster's New World On-Line Thesaurus* (from Simon and Schuster), *Word Finder* (from Microlytics), *Reference Set* (from Reference Software), *Turbo Lightning* (from Borland International), and *Whoops!* (from Cornucopia Software), are only similar in terms of their basic functions; when it comes to the fine points, there are notable differences.

Very recent enhancements (like *Reference Set*'s change from a 50,000-word to a 300,000-word lexicon) have made some programs quite different from what they were even a few months ago. New lexicons and other changes are in the works for at least three more programs, *Webster's*, *Word Finder*, and *Turbo Lightning*. In this field, the term *state-of-the-art* seems to be regaining some of its lost respectability.

At the heart of every thesaurus program there's an index file, which contains root words and commonly used terms; a large lexicon or dictionary file, which holds the synonym collection; and a command file, which runs the program. The size of the index file indicates whether the program will recognize a word in your document; the size of the lexicon file gives a rough measure of how many synonyms can be suggested as replacements for your word; and the design of the command file determines how efficiently the program's routines are performed.

The lexicon files in electronic thesaurus programs can be big—some need over 400K bytes of storage space. Even without considering the index file and command program, it's clear that a big thesaurus won't leave enough room in machine memory for your word processor, so at least some of it has to reside on a disk.

This is why many thesaurus programs provide you with large and small versions of their lexicon files. The smaller lexicon can be used in machine memory or transferred to the working copy of your word processor's disk. The larger lexicon usually resides on a hard disk or on its own floppy (though choosing the floppy disk alternative can sometimes involve some bothersome disk-swapping). *Reference Set*'s lexicon is so big it won't fit on one double-sided, double-density floppy disk. To run the program, you need either a high-density (1.2-megabyte) floppy drive or a hard disk.

■ Before you consider the features of different thesaurus programs, you need to determine which will work with your word processor.

MEMORY-RESIDENT PROGRAMS The command routines in all the thesauri are memory resident, which means they're loaded into machine memory and remain dormant there until they're needed. Your word processor is started afterwards. (All of the thesaurus programs can be loaded by batch files.) To use the thesaurus you press a predefined "hot key," and your word processing is suspended while the thesaurus seeks synonyms for the word that's at the cursor position.

In a few seconds, the thesaurus program superimposes a window on your document display. In the case of the best programs, this window will be positioned so you can still see the part of the screen from which the entry word was chosen. The thesaurus program's window occupies between one quarter and one half of your screen and holds a list of synonyms that can be substituted for the word in your document. The substitution is automatic: deleting entry words and inserting synonyms are handled by the program.

This is the theory, but sometimes there are snags. Memory-resident programs are notorious for interfering with other programs. Unless your thesaurus and word processing programs are compatible, you may experience crashes or other problems. Indeed, even with compatible programs, it makes sense never to start the thesaurus while your word processor is engaged in one of its operations.

Even before you consider the features of different thesaurus programs, you need to determine which will work with your word processor. Thus, the first step is to check the "Summary of Word Processor Compatibility" table, which contains information about the compatibility of the thesaurus programs and word processors. This information should be used with caution, however: most of it comes from the software developers themselves, and at times it can be unreliable. (The table lists compatibility for ten major word processing programs; for information on other applications programs, you should contact the software publisher.)

For example, the developers of *Word Finder*, *Reference Set*, and *Turbo Lightning* advertise that their programs are compatible with *Microsoft Word*. But when these programs were recently tested by *PC Magazine* (see "Four Ways to Find the Perfect Word," Volume 6 Number 1), the reviewer reported minor problems with all three of them.

At times it may take some fussing with a thesaurus's default settings to get it working properly with your word processor. All of the manufacturers offer technical advice by telephone, and their support personnel

are generally very knowledgeable about such subjects as compatibility and customization procedures.

OLDER WORD PROCESSORS A related problem is that some thesauri will run with recent releases of word processors but not with older versions of the same program. Unless you've spoken with someone who knows that a particular thesaurus will run with your word processor, it may be worth getting assurances from the dealer that the program you buy can be returned.

Another alternative is to call the manufacturer of the word processor or thesaurus program. New programs are constantly being tested by software developers, so they're likely to have recent information about a program you're interested in.

The fact that your word processor isn't listed among those that will run with a certain thesaurus doesn't necessarily mean that there's a compatibility problem. I tried all of the thesauri with *Samna Word IV*, a word processor that appeared in none of the manufacturers' lists of compatible programs. *Word Finder* and *Turbo Lightning* worked well with *Samna* (the *MultiMate* setting was best with *Word Finder*). *Webster's* retrieved synonyms but couldn't insert them into my document, and there were more serious problems with the other two thesauri. My tests with *MultiMate*, by the way, indicated that it was compatible with all five programs.

Because the amount of disk space available for lexicon files is limited, designers of electronic thesauri usually omit those words that seem less useful than others. This sometimes affects a program's ability to identify commonly used words or to provide useful synonyms. Hence, I performed some tests that measured how well the programs could perform synonym-retrieval and word-identification operations.

The words used in these tests all appear in the index of the desk thesaurus I never gave away, *Roget's International Thesaurus*, published by Thomas Y. Crowell. You can assume that a typical desk thesaurus would probably get a very high score on these tests.

The results of the tests appear in the "Relative Power" table. As the subtotals indicate, *Word Finder*'s large lexicon (220,000 words claimed) gives it an advantage in supplying synonyms once a word has been identified. But *Webster's* is better at recognition because it has 20,000 words in its index, in comparison to *Word Finder*'s 15,000 words.

The latest version of *Reference Set* marks the debut of the largest lexicon in any of the programs (300,000 words are claimed). This suggests that *Reference Set* should be the most powerful program. But because of an error in coding, it couldn't recognize an important test word, *head*. (If it had, it might well have gotten the highest score.) Such minor problems will no doubt be corrected in future releases of the program.

WORKING TOGETHER A margin of a few points in the performance test means very little. More important is how the parts of the program work together, and *Webster's*, *Word Finder*, and *Reference Set* all have their strong areas. In general, the programs are fairly equal in power.

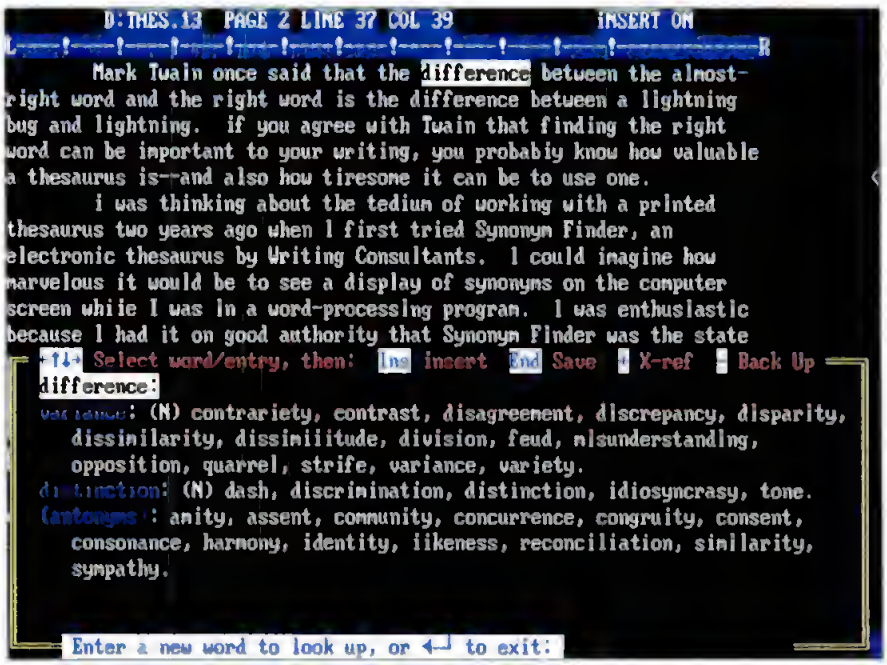
These three programs, however, are considerably more powerful than *Turbo Lightning* and *Whoops!*. The test results confirmed my intuitive sense that you'd need to use a printed thesaurus much more often with *Turbo Lightning* and *Whoops!* than with the other programs.

But this is true only when you take advantage of the power that the larger lexicons provide. If you have a hard disk, you'll have no problem. But if you're working with floppies, you may need to use one of the smaller lexicon files with your word processor. If so, it may make sense to start out with a program like *Turbo Lightning*.

Reference Set

Until recently, *Reference Set*, from Reference Software, had a 50,000-word lexicon, which meant that it was easily outclassed by *Webster's* and *Word Finder*. No longer. *Reference Set* now claims the largest lexicon of the programs tested—300,000 words in a 421K-byte file. This makes it a program for hard disk or high-capacity floppy disk users, since its lexicon is too large to fit on one 360K-byte floppy disk.

At the time of this writing, the disks for the new version were ready but the manual hadn't been printed, so I worked with a manual from *Reference Set*'s previous version. However, the program is easy to use,



We searched for synonyms for the same word, difference, *with each of the thesaurus programs.* Reference Set *offers 20 synonyms and a solid list of antonyms as well.*

PC MAGAZINE FACT FILE

***Reference Set*, Version 3.4**
Reference Software
330 Townsend, #135
San Francisco, CA
94107
(800) 872-9933
List Price: $69; with Spelling Checker, $89.
Requires: 128K RAM, one floppy and one hard or high-capacity (1.2-megabyte) disk drive, DOS 2.0 or later.
In Short: *Reference Set* is a big program that requires an XT or AT computer. Its recent change from a 50,000-word to a 300,000-word, 421K lexicon makes its word collection larger than that of any rival program. It's the only one of the larger programs that supplies antonyms. Not copy protected.

CIRCLE 662 ON READER SERVICE CARD

so I managed to get along without the revised manual.

Reference Set's power is evident in the verb-noun and modifier recognition tests, where it performed as well as or better than the other programs. It was outstanding in identifying business terms and foreign words. Like *Webster's* and *Word Finder*, it labels synonyms according to part of speech and then clusters words that are close in meaning, and it also permits you to do synonym chaining. After working with programs that lack these features, I've reached the point where I wouldn't want to do without them.

Reference Set has some useful extra features, including a glossary that lets you store and retrieve frequently used phrases and a utility for looking at a DOS directory without exiting from your word processing program. Such extras probably won't be needed by users of advanced word processors, but if your program lacks them, *Reference Set* might fill the gap.

Reference Set and *Whoops!* are the only programs in this group that supply antonyms as well as synonyms. The former's antonym selection is the superior one, so if this feature appeals to you, *Reference Set* might be a good choice. The version I tested came with a spelling checker, and the program is usually sold this way, but *Reference Set* can be purchased with the thesaurus alone.

The only flaw in *Reference Set* is that some of its synonym choices are misleading. Could *party* be considered a substitute for *devotion*, or *adventure* for *celebration*? With the word *pragmatic*, the alternatives seem even wider off the mark: *bureaucratic*, *officious*, and *red-tape*.

If the meanings of some words are at times extended, they're too narrow in other instances. For example, the only synonyms given for *therapy* are *analysis*, *psychiatry*, and *psychoanalysis*—missing is the sense that *therapy* can refer to the treatment of physical ailments.

At times the program wins back points lost for inaccuracy by being amusing, as in its list of synonyms for *client*: *ward*, *delinquent*, *dependent*, *minor*, *orphan*, *protégée*. Never mind that the idea of a client as a customer is lost. Every consultant knows that *delinquent* is an exact equivalent for the word *client*.

Emboldened by this insight, we can use *Reference Set* to gain a deeper understanding of the fascinating field of semantics. A *client* is a *ward* because he is a *dependent*; a *dependent* is in many instances a *minor*; a *minor* is unarguably a *juvenile*; and in today's modern world a *juvenile* is all too often, alas, a *delinquent*.

Moreover, we should consider the sad statistical probability that the *minor* became a *delinquent* because he was an *orphan* (Sociology 101); or rather, that she became one, given that our little *client* is not a *protégé* but a *protégée*. And if you find this logic extravagant, some *therapy* (*analysis*, *psychiatry*, *psychoanalysis*) should help make you less *pragmatic* (*bureaucratic*, *officious*, *red-tape*).

In most respects, *Reference Set* is a good program. It's easy to learn and powerful. But when it comes to choosing synonyms, my own preference is for those that tend to be synonymous.

Turbo Lightning

Webster's, *Word Finder*, and *Reference Set* are in a different class from *Turbo Lightning* and *Whoops!*. As the performance tests indicate, these two programs tend to recognize fewer words and to supply fewer synonyms than the rest. Borland International's *Turbo Lightning* identified only 8 out of 50 words in five recognition tests, a factor attributable to its small, 5,000-word index.

Like *Whoops!*, *Turbo Lightning*'s method of selecting synonyms is by pressing a letter key on the keyboard rather than with the cursor. In some cases, this may be the faster alternative, but it's a clue to the fact that you won't see more than 26 synonyms on the screen. In addition, *Turbo Lightning* lacks many of the thesaurus features commonly provided in the other programs. It doesn't support synonym chaining, and its synonyms aren't grouped according to shades of meaning, although parts of speech are noted.

Nor can *Turbo Lightning* deal with hyphens between words. Thus, though *ill-qualified* appears in its synonym list, the program will search for *ill* and *qualified* without recognizing that the hyphen has created a compound word.

On the other hand, *Turbo Lightning* is easy to use, and the screen display is attractive and moves out of the way of your text. In addition, its speed is good—on my computer it's a bit slower than *Webster's* but faster than all the other programs.

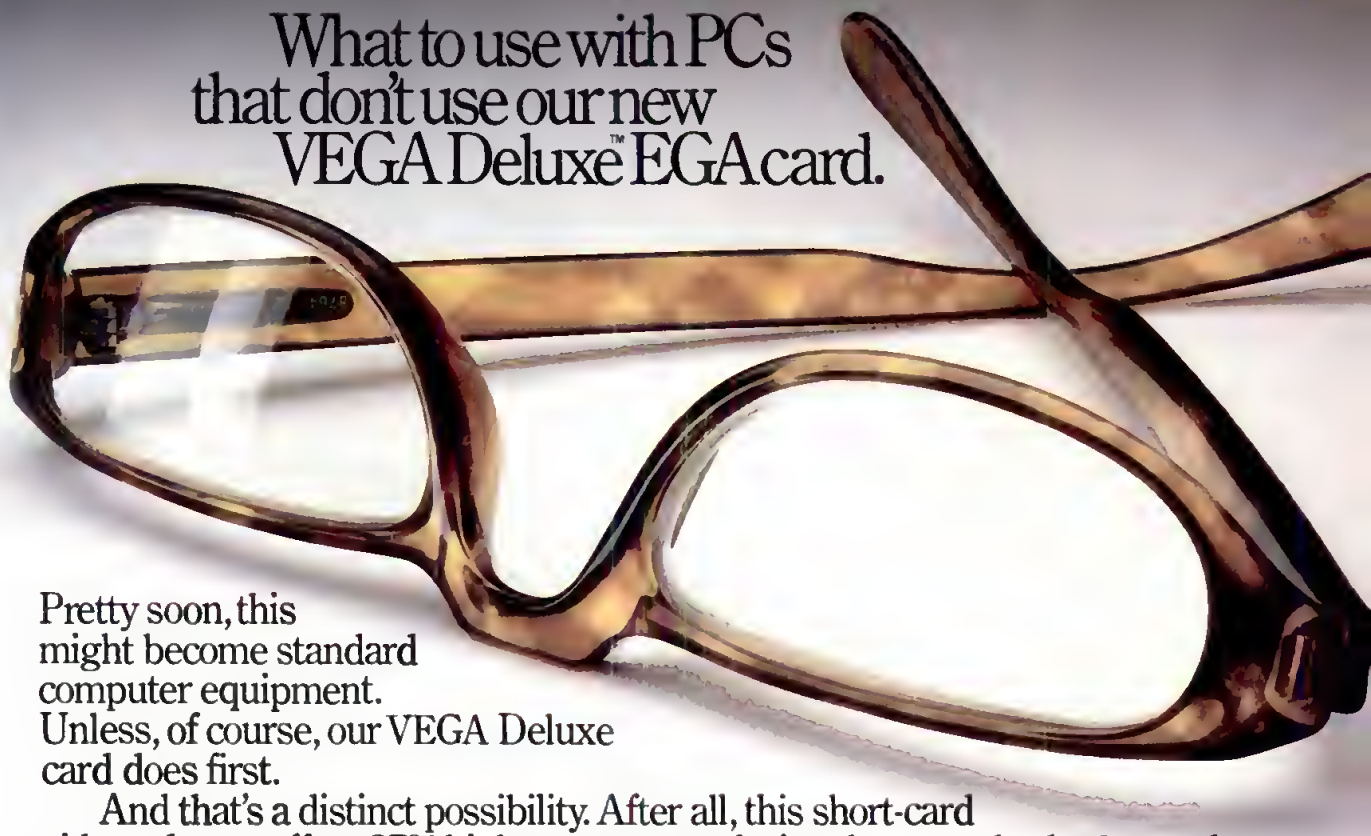
Turbo Lightning's name doesn't refer to its speed in thesaurus mode, but rather to

PC MAGAZINE FACT FILE

***Turbo Lightning*, Version 1.02a**
Borland International Inc.
4585 Scotts Valley Dr
Scotts Valley, CA 95066
(800) 255-8008
(800) 742-1133 (in Calif.)
List Price: $99.95
Requires: 128K RAM, two disk drives, DOS 2.0 or later.
In Short: *Turbo Lightning* has a relatively small, 50,000-word lexicon, which means that it can't recognize words and supply synonyms as well as programs that claim more words. It makes up for this with a real-time spelling checker that beeps when it doesn't recognize the words you type. Not copy protected.

CIRCLE 661 ON READER SERVICE CARD

What to use with PCs that don't use our new VEGA Deluxe™ EGA card.



Pretty soon, this might become standard computer equipment. Unless, of course, our VEGA Deluxe card does first.

And that's a distinct possibility. After all, this short-card video adapter offers 37% higher screen resolution than standard EGA cards.

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In fact, with all this information on the screen, there's only one thing there's less of. Strain on your eyes.

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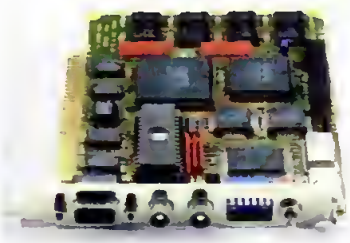

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CIRCLE 127 ON READER SERVICE CARD

■ *Turbo Lightning* is easy to use, and the screen display is attractive and moves out of the way of your text. In addition, its speed is good.

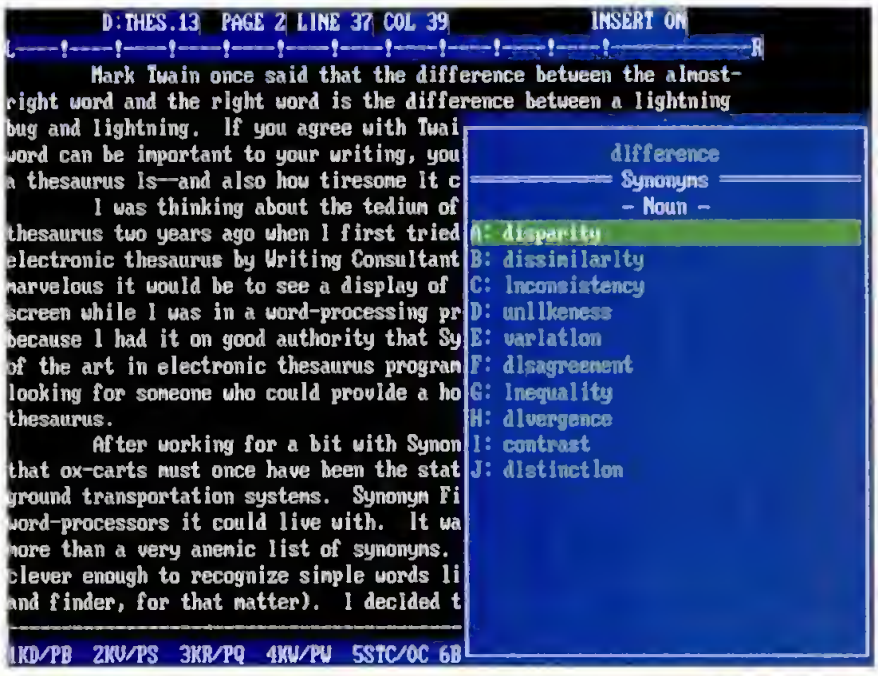
its performance as a spelling checker. It can beep at a word it doesn't recognize in the time it takes to go from typing the last letter of a word to pressing the Spacebar afterwards. This "real time" spelling check is an example of the kind of magic that will impress friends who are still skeptical about computers.

But the no-free-lunch principle is in effect here. In return for the real-time spelling checker you'll have to make do with a relatively weak thesaurus. (*Webster's* and *Reference Set* offer spelling checkers at an extra charge, but they're not of the real-time variety.)

Installing *Turbo Lightning* is a bit complicated. The instructions could be clearer, especially since some of the procedures are unconventional. For example, to change certain default procedures, you press Return before initiating the command.

Once the program is installed, however, things get better. One feature I particularly liked was the way you can change the hot-key assignments while you're in the program. You can also switch word processors or go from your word processor to another program, without rebooting *Turbo Lightning*. This feature is useful if you normally work with more than one program. And the program offers some unusual options, such as instructions for working with a RAMdisk and provisions for addressing machine memory above 640K.

Borland International has compiled a large lexicon that will be added to future releases of *Turbo Lightning*; this could well make the program very competitive. In the meantime, if you can't run one of the bigger thesauri and like the idea of a real-time spelling checker, *Turbo Lightning* could be the program for you.



Turbo Lightning's *relatively small lexicon produces only ten synonyms for* difference. *This program's real strength is its real-time spelling checker, not its thesaurus.*

Webster's New World On-Line Thesaurus

Webster's New World On-Line Thesaurus, from Simon and Schuster, is a well-designed program. It's not quite as good as *Word Finder* in supplying synonyms, but it is superior to the other programs in a number of areas.

For example, *Webster's* excels at word recognition—an important category, because an entry word has to be identified before the program can offer up any synonyms. This strength is based on a special feature: in addition to its 20,000-word index file, the program has a special root-word and derivative file with 64,000 words.

Webster's also has a number of smart features—routines that make necessary changes in the synonyms before substituting them in your document. Most thesaurus programs are smart enough to add capital letters to a substitute word when needed (see "Summary of Operational Features" table). But *Webster's* goes one step further. If you start out with a verb in the past tense that ends with an *-ed*, the program will give you the option of adding the same suffix to the synonym. (Even so, *Webster's* can't handle irregular verbs.)

THE GENUINE ARTICLE In the same way, the article preceding a word in your document is checked and changed, if necessary, after a substitution. Thus, if you start out with *pear* and substitute *apple*, *Webster's* will automatically change the *a* before *pear* to *an* so it will agree with *apple*. It's a handy feature.

Webster's will suggest adjectival and adverbial forms of a root word where appropriate; this again saves you the trouble of retyping the substituted word. Even more impressive is the way the program checks both sides of an entry word to see if it's part of a phrase. *Webster's* can recognize common phrases such as *in fact*, *at once*, and *on account of*.

Webster's starts out with a single display that takes up about half the screen. If you ask for the synonym of a synonym, a second screen is displayed next to it so you can choose a word from either one. At this point, your original document is almost obscured, but you can window back to it if

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System requirements: *IBM PC/AT/XT Portable or 100% compatibles. IBM Monochrome or Color Graphics Adaptor Board or Hercules Monochrome Graphics Card. 1200/2400 Hayes Smartmodem or compatible modem. Double-sided Disk Drive. 256k Memory. MS DOS 2.1 or higher. Please specify if you have IBM PCjr. IBM Enhanced Graphics Adaptor (or compatible). AT&T 6300; pr IBM 3270.*

**To be used within 30 days after you purchase the program*

CIRCLE 733 ON READER SERVICE CARD

On-line Thesauri: Summary of Features

(Products listed in ascending price order)

GENERAL FEATURES

	Whoops!	Reference Set	Webster's New World On-Line Thesaurus	Word Finder	Turbo Lightning
List price	$49.95	$69.00	$69.95	$79.95	$99.95
Printed thesaurus used as basis	None	Random House	Webster's New World	None	Random House
Comes with two thesaurus sizes	●	○	○	●	●
Thesaurus sizes (bytes)	106K 37K	421K	358K	325K 160K	162K 161K
No. of words claimed in thesauri	90,000 82,000	300,000	120,000	220,000 120,000	50,000 50,000
No. of index words claimed	12,000	30,000	20,000	15,000	5,000
RAM requirement	72K	46K	44K	35K	65K
Spelling checker	●	Optional	Optional	○	●
Documentation	●	●	●	●	●
Index in documentation	●	Info. not available*	○	○	●
Quick reference card	○	Info. not available*	●	●	○
Retrieval time (seconds) 8088 PC with hard disk	4–10	4–8	3–4	4–9	3–6
Mobility of screen display	None	Up, down	Left, right	Up, down	Left, right
Removable from RAM without rebooting	●	●	●	●	●

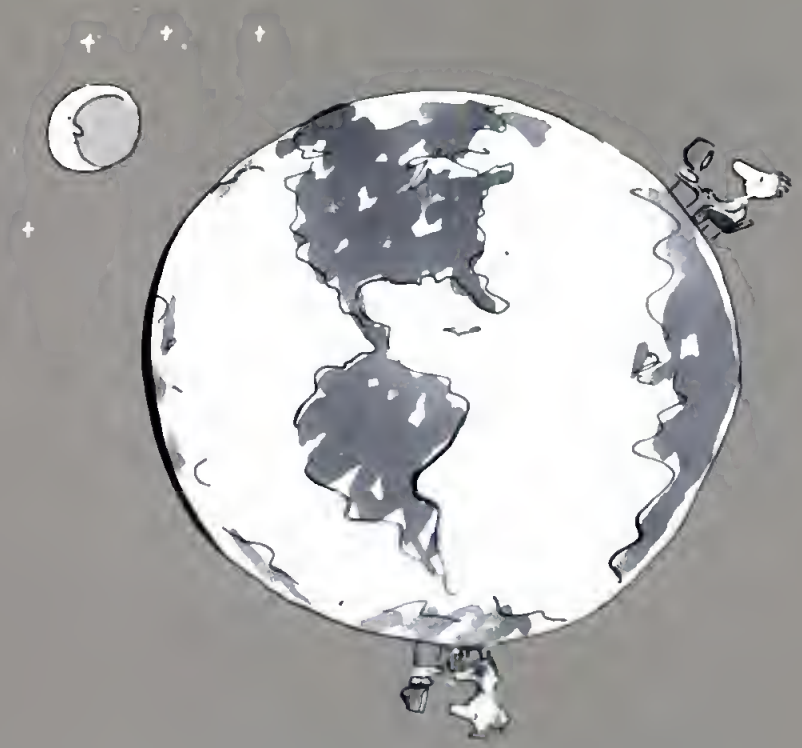
OPERATIONAL FEATURES

	Whoops!	Reference Set	Webster's New World On-Line Thesaurus	Word Finder	Turbo Lightning
Method of synonym selection	By letter in display	Cursor, by word	Cursor, by word	Cursor, by word	By letter in display
Clusters synonyms by parts of speech	○	●	●	●	●
Clusters synonyms by meaning	○	●	●	●	○
Supports synonym chaining	●	●	●	●	○
Tracks or restores previous synonym display	●	●	●	●	○
Recognizes hyphens linking whole words	●	●	●	●	○
Recognizes unhyphenated compound words	○	○	●	○	○
Adds caps when replacing capitalized words	●	●	●	●	●
Can redefine function keys	●	●	●	●	●
Excludes all nonsynonyms	○	○	●	●	●
Supplies antonyms	●	●	○	○	○
Contains undo feature	○	○	●	○	○
Permits windowing back to document	○	○	●	○	○
Reconfigures plurals	○	●	●	●	○
Replaces plurals with plural synonym	○	○	●	○	○
Makes "a"/"an" article changes	○	○	●	○	○
Permits screen dump of synonym display	●	●	●	●	●

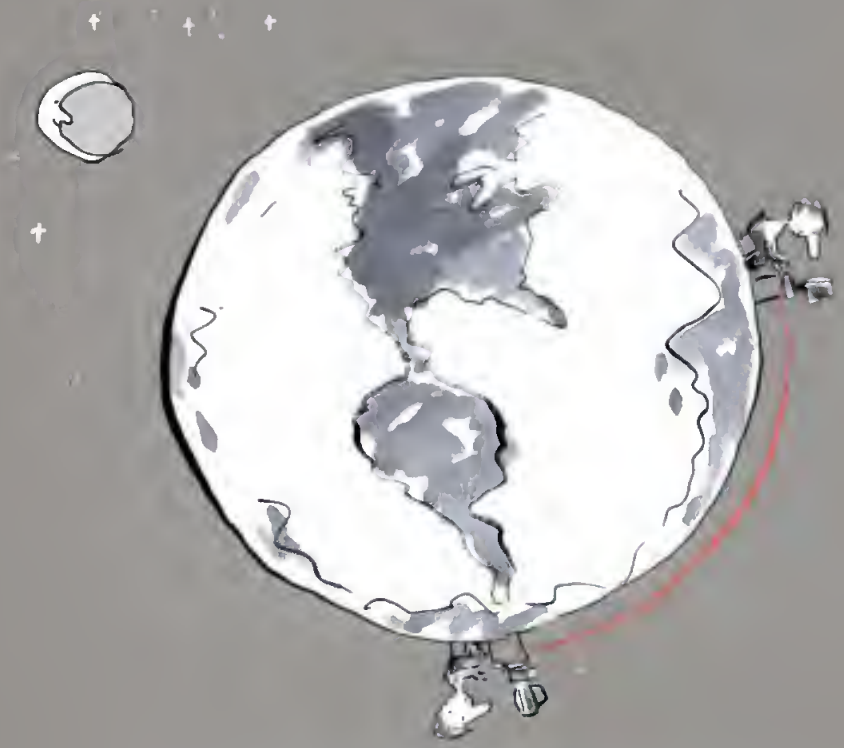
WORD PROCESSOR COMPATIBILITY

	Whoops!	Reference Set	Webster's New World On-Line Thesaurus	Word Finder	Turbo Lightning
DisplayWrite	●	○	●	●	●
Microsoft Word	●	●	●	●	●
MultiMate	●	●	●	●	●
OfficeWriter	●	●	●	●	●
PFS:Write	●	●	●	●	●
Samna Word IV	○	○	○	●†	●†
Volkswriter	●	●	●	●	●
WordPerfect	●	●	●	●	●
WordStar	●	●	●	●	●
WordStar 2000	●	●	●	●	●
Writing Assistant	●	●	●	●	●
XyWrite III	○	●	●	●	●

PC —Indicates Editor's Choice
●—Yes ○—No
*Revised documentation not printed at time of review.
†Some customization is necessary



1981: The PC Changed the Way
the World Worked.



1987: Western Digital Changes the Way
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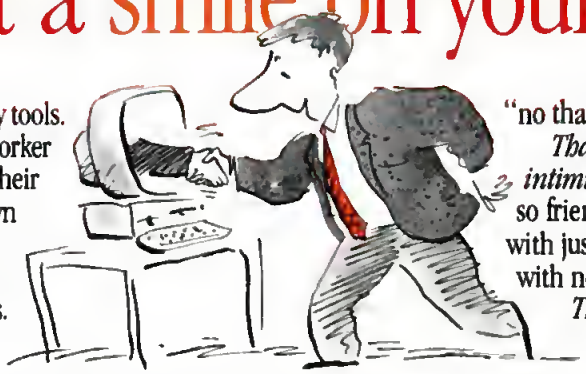

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Today, ViaNet software runs on our standard Ethernet and StarLAN network hardware.

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Perhaps, we say, unless they're based on ViaNet.

VIANET. IT THRIVES ON SIMPLICITY.

ViaNet is a genuine alternative to networking schemes you've said "no thanks" to in the past.

Thanks, but networks are too intimidating. Not with ViaNet. It's so friendly that users start sharing with just ten minutes of training, with no new commands to learn.

Thanks, but networks are too costly. Not from Western Digital. With our StarLAN family of products, and ViaNet, we've driven network cost per PC under $400. Or, if you prefer the higher performance of Ethernet LANs, our EtherCard PLUS™ is hundreds less than competitive boards. And heading lower.

Both StarLAN and Ethernet are international standards, too. So your network is a mainstream investment.

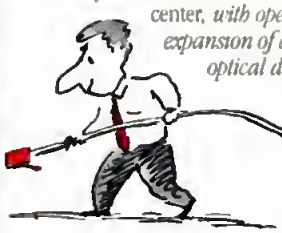
Thanks, but I've heard that cabling installation can be awfully expensive. Yes, except StarLAN uses your building's existing telephone wiring — without disrupting your phone system.

Thanks, but network file servers are too big an investment. With ViaNet, you don't even need one. All network PCs are created equal, and data stored on hard disks and every printer in the place is accessible to all users. Instantly.

Thanks, but I need more flexibility than networks provide. ViaNet thrives on change, too. It

ViaNet is ideal for small businesses and departments in large companies. It was designed from the start to end PC isolation and boost PC productivity.

Just plug our VersaStak™ system into an ordinary PC to turn it into a resource sharing center, *with open-ended expansion of disk, tape and optical disk storage.*



The Phone Company has given ViaNet a plug — your building's existing phone wiring. Save the expense of recabling. Gain the flexibility of adding stations wherever there's a phone

lets you put users and their printers and hard disks anywhere you like, and add or delete resources anytime you like. Combined with StarLAN, it lets you add a PC wherever there's a phone jack, and move stations around even while the network is running.

Sorry. You're out of excuses. Now start sharing.

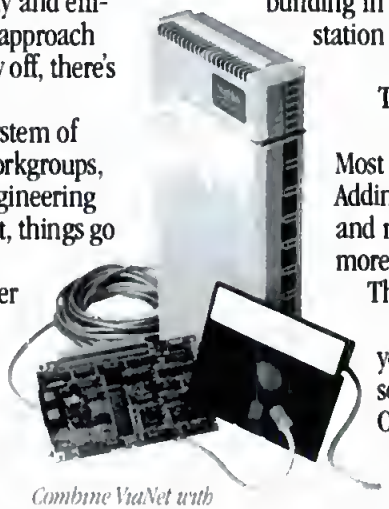
THE VIANET ADVANTAGE.

When you're shopping for a network, when you're looking for a way to boost productivity and efficiency, when you're desperate for an approach that makes your investment in PCs pay off, there's just one word to remember: ViaNet.

ViaNet is the network operating system of the future. Here today. From small workgroups, linked by StarLAN, to full floors of engineering workstations, tied together by Ethernet, things go more smoothly with ViaNet.

First of all, ViaNet couldn't be easier to use. And the easier computers are to use the more often and more effectively they'll be used.

ViaNet enables you to fully distribute computing power, with every user equal and independent. Unlike competing approaches, with a minicomputer mentality that takes the "Personal" out of "PC."



Combine ViaNet with our StarLAN adapters or EtherCard PLUS adapter for a complete solution from a single supplier

ViaNet lets every PC do its own processing, too, running either DOS or XENIX. And it's compatible with most every application program imaginable. So the software you're using today is a keeper.

Finally, ViaNet gives you four levels of security, including complete file and record locking and password protection, too. So sharing won't cause chaos. Or even loss of privacy.

THE INSTALLATION ADVANTAGE.

The surprise expense in PC networking has been cabling installation. Coax connections not only cost a bundle: They require you to decide in advance how many PCs you'll need to connect — and where they'll be.

Combine ViaNet with StarLAN and you can connect a PC wherever there's a phone jack, taking advantage of unused pairs in the existing wiring, and adding new PCs whenever you want.

PCs can be linked from floor to floor or even building to building in various multistation configurations.

The Network Courier™ is our solution to real time communications. Send and receive messages without leaving the application you're working on

THE FLEXIBILITY ADVANTAGE.

Most businesses never stop changing. Growing. Adding people. Adding offices. Finding PCs more and more important as they're used for more and more applications.

That's where ViaNet really shines.

Even while the system is up and running, you can add stations or peripherals or new software in seconds. Without a programmer. Or a degree in astrophysics.

Just unplug your PC, wheel it down the hall to your new office and plug it back in. Voilá! You're up and running.

Adding new users is just as easy.

So is adding entire departments.

Or linking your department's ViaNet system with bigger, more complex networks you may have already installed.

So why be tied down with more complex approaches? Give us a call today at (800) 847-6181.

Our powerful, low cost EtherCard PLUS is perfect for high performance networks

Here's how we make ViaNet work for you.

ViaNet delivers on the promise of simplicity and flexibility in networking.

And for most PCs, in most work groups, combining ViaNet with StarLAN is the best example of that simplicity and flexibility.

It starts with our StarLink™ adapter, which enables you to daisy chain up to 11 PCs.

Or choose StarHub,™ a standalone hub that interconnects up to ten levels of work groups. Connect PCs directly to StarHub with our lowest-cost interface, StarCard.™ Connect StarLink daisy chains, too. And connect other StarHubs, each with its own combination of single stations and StarLinks, in a near-endless variety of configurations.

In other words, StarLAN conforms to your workstyle and physical environment. Not vice versa.

STARCARD PLUS AND ETHERCARD PLUS: MORE PERFORMANCE, MORE VERSATILITY.

StarCard PLUS™ is our high performance StarLAN interface, for simplicity without compromise.

A shared 8K buffer memory means no DMA channels and higher access speeds.

Use it to turn PCs in your network into fast file servers and workstations.

EtherCard PLUS opens up the world of high performance LANs and corporate-wide networks. And EtherCard PLUS shares software drivers with StarCard PLUS, to simplify mixing and matching networks.

VERSASTAK: THE OPEN-ENDED ANSWER TO SHARED DATA.

ViaNet will grow on you. The more you use it, the less you can live without it. And the amount of data you need to store and have ready access to will keep growing, as well.

Our VersaStak Peripheral Subsystem is the answer.

Plug it into any PC with a single interface card, and give every user on the network access to VersaStak's files.

VersaStak literally stacks up to seven storage peripherals. Choose high performance VersaDisk™ hard disk modules, in 85 and 170 MB capacities. Start with one and add more modules later.

Backup your data on tape with VersaTape™ 60 or 120 MB cartridge tape modules.

And to put a virtual library of information at everyone's fingertips, add the VersaROM™ 500 MB optical disk module.

HOW TO GET STARTED.

Nobody puts it all together like Western Digital. And it all starts with ViaNet. So get a handle on improved productivity, and teach your PCs to share. Let us help. Just give us a call at (800) 847-6181.

Western Digital, 2445 McCabe Way, Irvine, CA 92714

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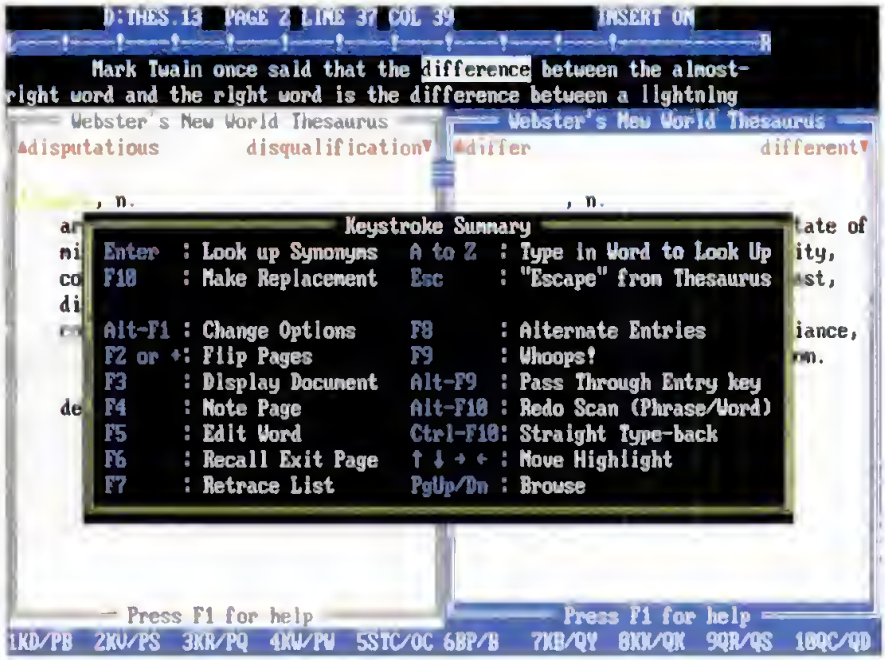
WESTERN DIGITAL



The help screen for Webster's New World On-Line Thesaurus *indicates how complete the program is. The F7 key, for example, generates a list of the words looked up in the current search.*

you wish. The program also has an undo feature that lets you restore your original word if you change your mind after a synonym has been substituted in your document. In general, *Webster's* special features are superior to those in the other programs.

I was also impressed by *Webster's* crisp performance. On my computer—an IBM PC with an add-on hard disk—the thesaurus programs took from 3 to 10 seconds to display the initial list of synonyms. *Webster's* was always at the speedy end of this scale—its display took no longer than 4 seconds to reach the screen. (If you have an AT or another 286-processor computer, retrieval times will, of course, be faster, and you can expect them to be slower if you're using a floppy-disk-drive machine.)

One reason *Webster's* is so fast is that it doesn't initially display all the synonyms it has available. Instead, you're given a selection with words grouped according to parts of speech (noun, verb, modifier) and shades of meaning. You can then retrieve more synonyms from the category you choose. This synonym chaining works very well; you can go from display to display very quickly until you find the word you need. *Webster's* also makes it easy to go back to a display you looked at earlier if you wish.

Webster's 120,000-word lexicon may seem small compared with those in *Word Finder* and *Reference Set*, but the program is very powerful nevertheless. (I suspect that each software developer uses a different formula for counting lexicon words, so these numbers may not be comparable.)

Webster's has a good on-line help facility; its manual is clear, and it comes with a handy command-summary card. It has an orderly and attractive screen display and intuitive commands. It's easy to learn and use. I liked it.

Whoops!

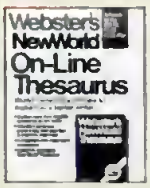
Cornucopia Software's *Whoops!* is a *Turbo Lightning* look-alike, designed to provide similar features at a lower price. Like *Turbo Lightning*, it has a good real-time spelling checker and a fairly small thesaurus. The full name of the program is *Whoops!—The Real-Time Spelling Checker*; this indicates where the program's strong points lie.

The *Whoops!* thesaurus is easy to use, but it has some irritating eccentricities. It takes two commands to get into or out of the thesaurus display, versus one in the other programs; and there are different exit commands—one when the program recognizes a word, and another when it doesn't. This makes the program harder to work with than it need be.

In spite of the small number of synonyms it retrieves, *Whoops!* is fairly slow.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE



***Webster's New World On-Line Thesaurus*, Version 1.07**
(Developed by Korenthal Associates Inc.)
Computer Software Division
Simon and Schuster Inc
One Gulf + Western Plaza
New York, NY 10023
(800) 624-0023
List Price: $69.95
Requires: 128K RAM, two disk drives, DOS 2.0 or later.
In Short: Despite its 120,000-word lexicon, *Webster's* performs as well as programs that claim more words. It's fast, easy to use, and comes with many attractive extra features, such as the ability to recognize phrases and to make *a/an* article changes in your document. Not copy protected.

CIRCLE 660 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

***Whoops!*, Version 3.2k**
Cornucopia Software
P.O. Box 6111
Albany, CA 94706
(415) 528-7000
List Price: $49.95
Requires: 128K RAM, two disk drives, DOS 2.0 or later.
In Short: *Whoops!* is a *Turbo Lightning* look-alike with a 90,000-word lexicon and a real-time spelling checker. Its cost is lower than that of rival programs and its thesaurus is somewhat more powerful than *Turbo Lightning*'s. But it lacks some important features and doesn't eliminate nonsynonyms from its display. Not copy protected.

CIRCLE 659 ON READER SERVICE CARD

■ A thesaurus should be helpful in resolving questions about the gray areas that lie between familiar and obscure words, but *Whoops!* is useless for this purpose.

Of the programs tested, it has the least attractive screen display, and unlike the other programs, its window won't move out of the way so you can see the portion of the screen with your entry word.

PRODUCE AND SUCCUMB *Reference Set* is occasionally capricious in displaying misleading synonyms. In *Whoops!* this is unabashedly the rule. Here are some examples of entry words followed by selections from the suggestions for synonyms: *file* and *diameter*, *point* and *level*, *negotiation* and *soviet*, *god* and *headman*, *help* and *cane*, *person* and *matchless*, *produce* and *succumb*. Nouns are at times listed as equivalents of adjectives—*nonsense* and *crazy*, for example. This feature is handy if you need to encrypt secret messages, e.g., "Headman cane the matchless who succumbed this crazy."

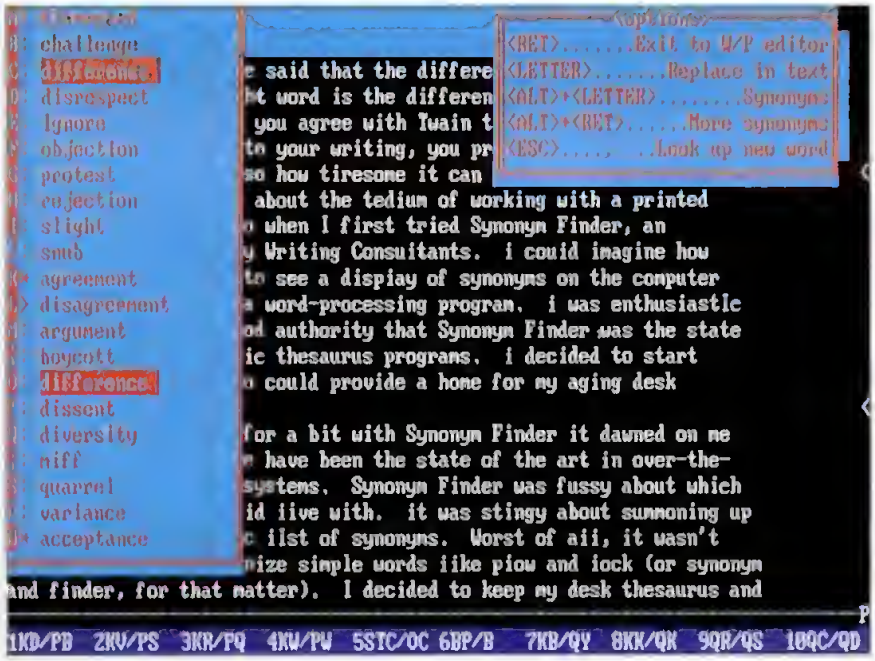
At times a majority of the suggested synonyms aren't valid. An example is that old favorite, *client*; *patient*, *forbearing*, *indulgent*, and *suffering* are the only suggested synonyms. Clearly, the program's cross-referencing routine isn't capable of making distinctions between the different meanings of a word like *patient*.

It's annoying to have to wade through a list of irrelevant terms for the sake of so few synonyms—synonyms that you could think of on your own. You're being asked to do work that should be done by the program, and whatever you save in dollars when buying *Whoops!* is soon lost in the form of wasted time.

The *Whoops!* displays don't group words by meaning or by part of speech, so its synonym lists take a long time to read; you're forced to think about the nuances of words that turn out to be irrelevant to your needs. This problem becomes even more severe when you're dealing with one of the many English words that retain the same spelling with numerous definitions. (The word *set* is an extreme example of this type of word: the index in my desk thesaurus lists over 300 shades of meaning for it.)

A thesaurus should be helpful in resolving questions about the gray areas that lie between familiar and obscure words, but *Whoops!* is useless for this purpose. Unless you're already knowledgeable about the synonyms you find, you may make some embarrassing choices. On the other hand, if you have any semiliterate enemies, you could send them *Whoops!* for Christmas.

The thesaurus portion of the *Whoops!* program is in its first release and will undoubtedly improve. For now, though, your best choice is one of the programs that comes closer to representing the state of the art.



The vertical display of synonyms in Whoops! *also includes a few antonyms, which are marked with asterisks. Words are not grouped by meaning or part of speech and take a while to read.*

Word Finder

I liked Microlytics' *Word Finder*—enough that I've forgiven it the sins of its youth. As the performance tests indicate, its strong point is an ability to deliver an unusually large number of synonyms. For *run* as a verb, it provided 59 alternatives; for *head* as a noun, 70. These figures aren't that far from what you'd expect to find in a printed thesaurus. *Word Finder*

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Word Finder,
Version 3.4
Microlytics Inc.
300 Main St.
East Rochester, NY
14445
(716) 377-0130
List Price: $79.95

Requires: 128K RAM, two disk drives, DOS 2.0 or later.

In Short: *Word Finder*'s strength is its ability to supply large numbers of synonyms for the words it recognizes, and it outperforms the other programs in this area. Though it has few extra features, it's straightforward, easy to learn, and easy to use. Not copy protected.

CIRCLE 658 ON READER SERVICE CARD

Performance Tests: On-line Thesauri Relative Power

Common Words

	Word Finder	Webster's New World On-Line Thesaurus	Reference Set	Whoops!	Turbo Lightning
Number of synonyms	23	17	15	5	10
Made verb-noun distinctions	8	9	9	6	7
Made modifier distinctions	8	9	10	6	4
Subtotal, common words	39	35	34	17	21

Words used for tests

Number of synonyms

love (nouns)	run (verbs)
love (verbs)	look (nouns)
head (nouns)	look (verbs)
head (verbs)	help (nouns)
run (nouns)	help (verbs)

Verb-nouns

interest	claim
forge	stete
draw	crown
plot	lease
plan	chisel

Modifiers

economical	matchless
obligatory	nocturnal
speedily	thoughtful
comprehensible	pragmatic
furry	fortunate

Scoring: common words

Number of synonyms
30 + = 3 points
20–29 = 2 points
10–19 = 1 point
0–9 = 0 points

Verb-nouns
Recognized both verb and noun = 1 point

Modifiers
Recognized word exactly as listed = 1 point

Less-common words

	Word Finder	Webster's New World On-Line Thesaurus	Reference Set	Whoops!	Turbo Lightning
Identified rare words	8	10	8	3	0
Identified professional terms	5	8	6	2	1
Identified business terms	8	10	9	3	5
Identified colloquial terms	9	4	6	5	1
Identified foreign words	2	3	5	3	1
Subtotal, less-common words	32	35	34	16	8

Words used for tests

Rare words

platitude	matriculate
phlegmatic	resonate
cabal	inchoate
encumbrance	diurnal
sedentary	labyrinth

Professional terms

serum	voltage
electronic	therapy
docket	computer
forensic	aircraft
indictment	diocese

Business terms

shareholder	consumer
mortgage	marketing
advertising	warehouse
assessment	consign
revenue	remit

Colloquial terms

crocked	gab
savvy	snitch
spool	snafu
wacky	goofy
gyp	crackpot

Foreign words

allegro	panache
gaffe	wanderlust
bourgeois	junta
senorita	ergo
chic	erratum

Scoring: less-common words

Rare words
Recognition = 1 point

Professional terms
Recognition = 1 point

Business terms
Recognition = 1 point

Colloquial terms
Recognition = 1 point

Foreign words
Recognition = 1 point

The thesaurus programs were subjected to eight tests. The words used in these tests all appear in the index of a popular desk thesaurus, *Roget's International Thesaurus*, published by Thomas Y. Crowell.

Number of synonyms for common words: To compete with a desk thesaurus, an electronic thesaurus should provide at least 20 synonyms for both noun and verb forms of common words such as *love* and *head*. Desk thesauri usually contain many more synonyms. In this test, a program was given 3 points for 30 or more synonyms; 2 points for between 20 and 29 synonyms; 1 point for between 10 and 19; and no points for 9 or fewer.

Made verb-noun distinctions: Many English words have meanings as both nouns and verbs (thus, *forge* can refer either to a furnace or to the act of counterfeiting). Noting the parts of speech makes a thesaurus more useful.

Made modifier distinctions: In order to save room, electronic thesauri don't always store every form of a word; instead, the programs may drop endings like *-ness* or *-ly* from modified words and then test whether a root word can be identified. Because there are exceptions to the ways modifiers are formed, such routines don't always work. Testing for the recognition of modifiers with different suffixes indicates how well a program copes with such words.

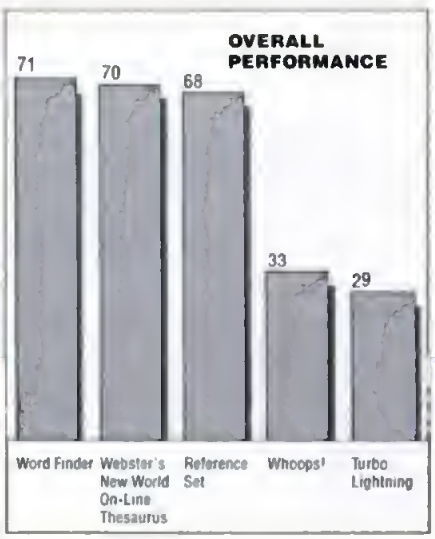
Identified rare words: This test determined whether the thesaurus programs could identify words that are somewhat uncommon in ordinary usage.

Identified professional terms: Computers are regularly found in professional environments. The words in these tests are commonly used in professions such as law and medicine but are familiar to most people.

Identified business terms: The words in these tests are often used in business.

Identified colloquial terms: Most people commonly use colloquial terms; including them in a thesaurus is particularly important for nonnative speakers.

Identified foreign words: Many electronic thesauri skimp on including foreign words, even those that have already crossed the boundary into English. The words in this test are known to most English-speaking people.



"We looked at every I mean everything. was even in their

Mike Macewich, Senior Decision Support Consultant, The Quaker Oats Company.

It had to make word processing so easy, no manager would want to manage without it. So sophisticated, even a secretary couldn't find a missing feature. So adept, it would make everyday memos look like they came out of a printshop. So simple to learn, people would be up and running the very first day.

It had to show on screen what you'd get on the printed page. It needed a full featured outline processor. It had to have comprehensive training on the disk and right at your fingertips.

It had to lay down columns in parallel. Generate indexes or tables of contents. Convert files from other word processors to its own. Get its money's worth out of sophisticated laser printers.

And be able to connect smoothly with any of the major network systems.

Microsoft® Word. If you put words on paper to make a point, close a sale, push a proposal, argue a cause, you couldn't insist on more word processing power than Quaker did.

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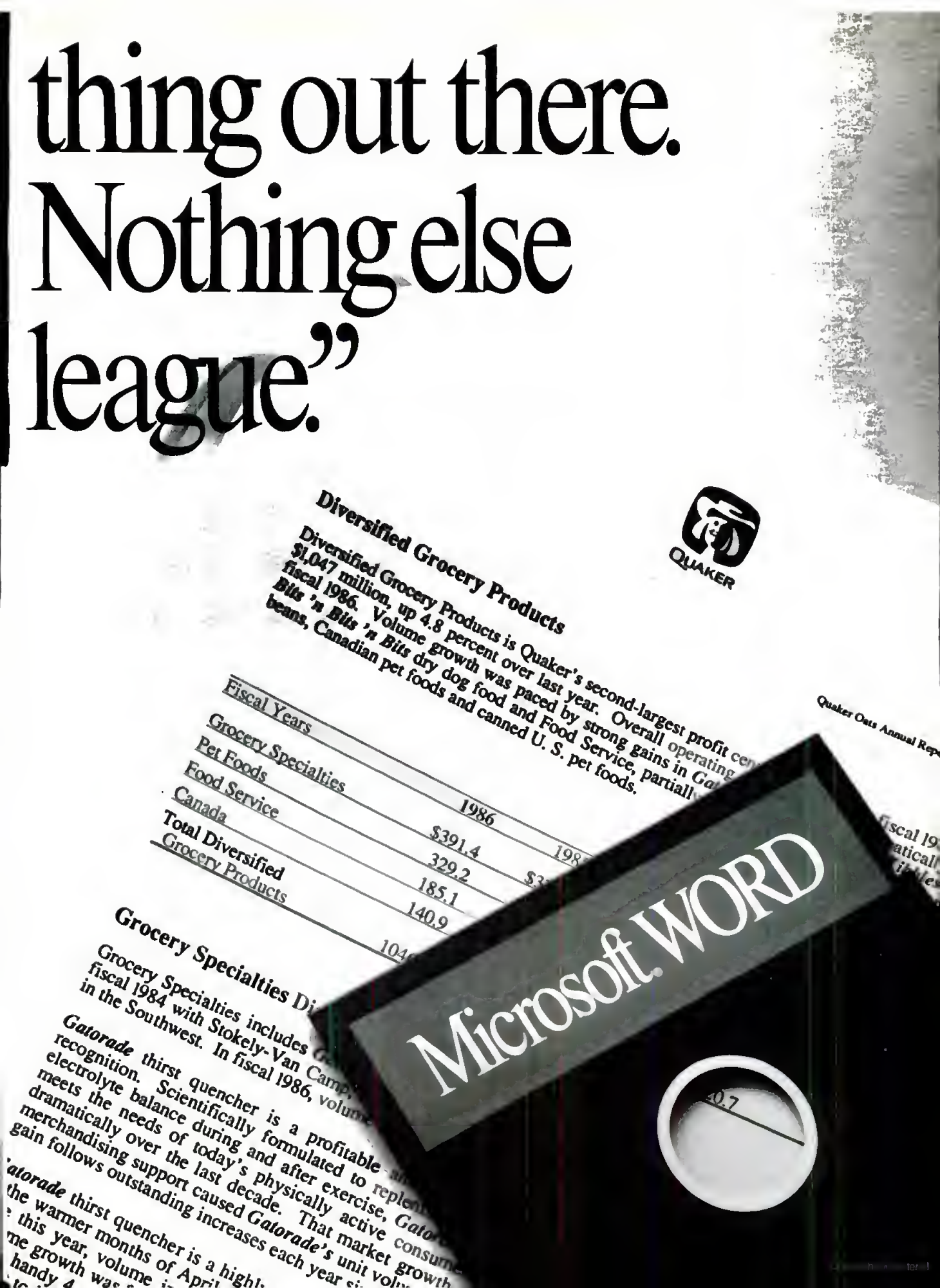
thing out there. Nothing else league."



■ *Word Finder* is a treat to use. It's a down-to-earth program with a simple philosophy: forget about bells and whistles and give the people more synonyms.

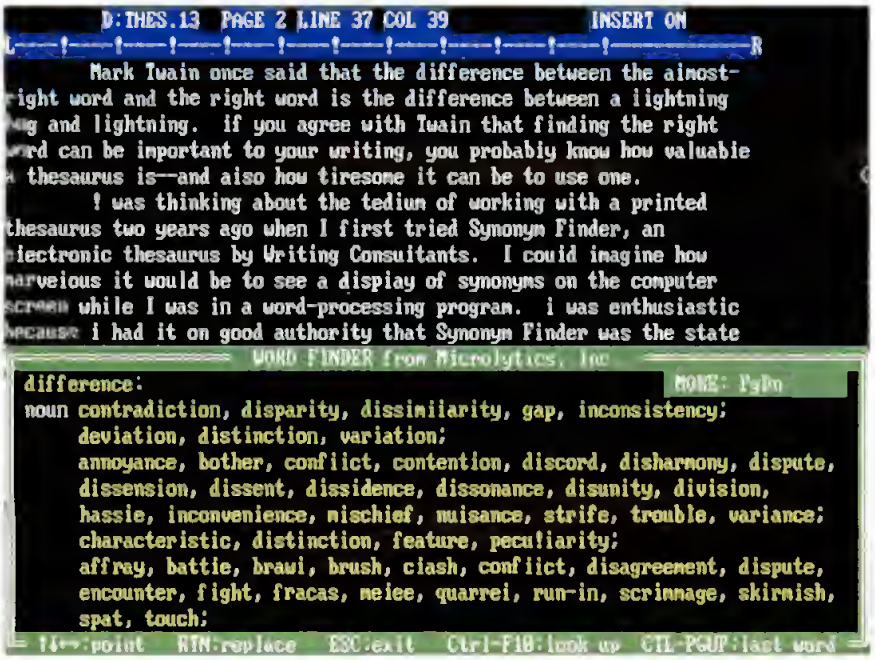
uses special data compression techniques to fit its large lexicon (220,000 words claimed) onto a single floppy disk.

Unlike some other programs, *Word Finder* doesn't require a lot of cross-referencing before you see the word that you want—its large display window is usually filled with synonyms. This has advantages as well as disadvantages: it takes fewer keystrokes than other programs do to display a word, but more keystrokes to retrieve it.

When there are too many synonyms to fit into the window (it holds about 60 words), a message instructs you to press the PgDn key for another display. Putting a large number of words in a single display can make it a bit hard to read. But most of the time I preferred *Word Finder*'s approach—getting lots of synonyms on the first screen.

Though *Word Finder* isn't based on a printed thesaurus, its synonyms have been intelligently selected and grouped in a logical way. At times, however, the program needlessly repeats words. Thus, when *love* is the entry word, the synonyms *admire*, *adore*, *cherish*, and *respect* all appear twice in the same display (such duplicates weren't counted in the test scores). This repetition sometimes blurs the distinctions between aggregates of words that are grouped by meaning and adds to the time it takes to read the synonym lists.

Word Finder ran somewhat more slowly on my computer than *Webster's* and *Turbo Lightning*. It took from 4 to 9 seconds to create a synonym display: the more words it retrieves, the longer it takes. Unlike the other programs, *Word Finder* needs about a second after the Escape command before its display disappears.



Word Finder's *specialty is big answers to little questions. The word* difference *elicits a catalog of related words. There are even more options, accessible with the PgDn key.*

PC MAGAZINE EDITOR'S CHOICE

- **Webster's New World On-Line Thesaurus**
- **Word Finder**

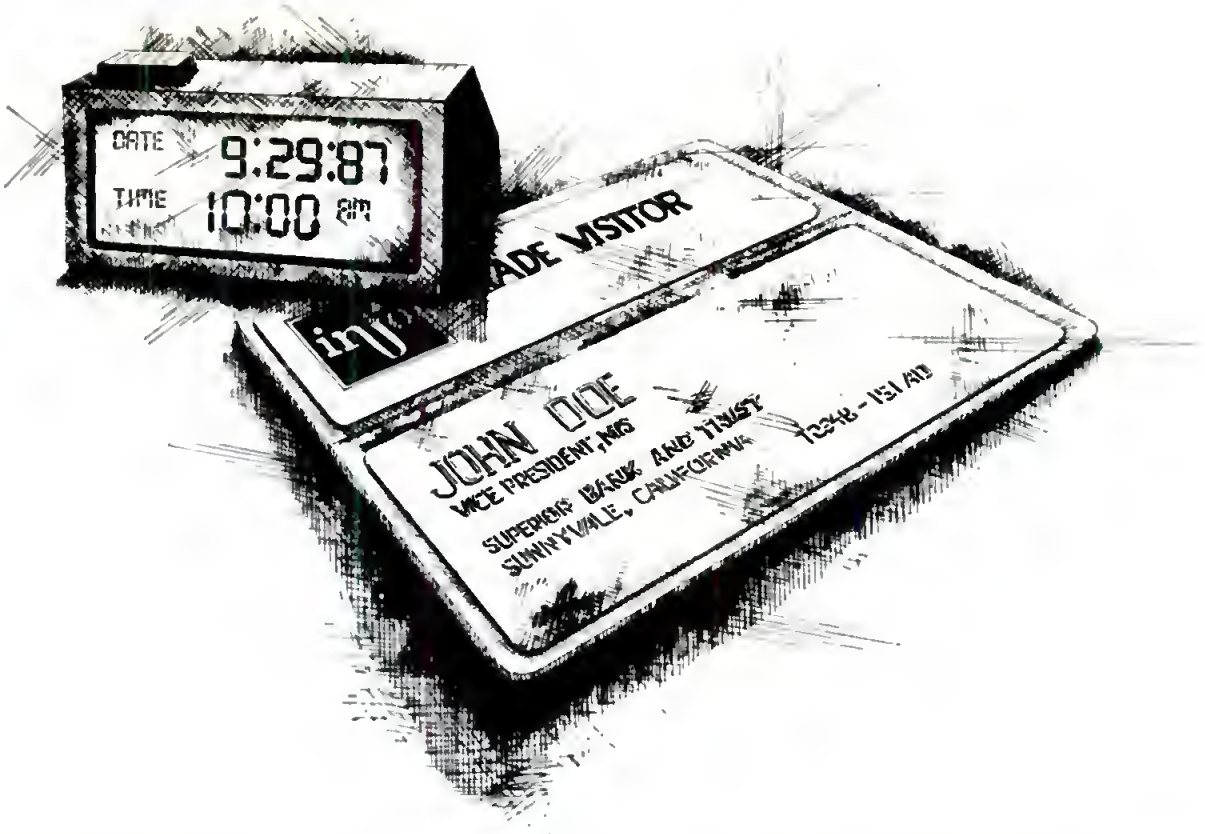
Webster's New World On-Line Thesaurus *is the best of the programs tested in its ability to recognize entry words. Roughly equal in power to the two other large programs, it moves ahead of the pack when it comes to providing useful special features.* Word Finder *compensates for a lack of extras with its impressive ability to retrieve large numbers of synonyms—and this is what most people look for in a thesaurus. While both programs are easy to learn and work with, each one will serve the needs of a certain group of user best. As happened the last time* PC Magazine *tested these programs, we have a tie.*

Word Finder is a good enough program that a number of software companies have begun to market it together with their own products. The growing list of word processors that are bundled with *Word Finder* includes *Microsoft Word*, *WordStar*, *Easy*, and *Q&A*.

You won't find many of the special features that are standard in *Webster's* here, but you may not miss them. One addition that did come in the latest release is a convenient way of entering words from the keyboard while you're in the synonym window.

In general, *Word Finder* is easy to learn and a treat to use. It's a down-to-earth program with a simple philosophy: forget about bells and whistles and give the people more synonyms. If this approach seems to make sense, *Word Finder* won't disappoint you.

Rubin Rabinovitz is a professor of English at the University of Colorado at Boulder and the author of Samna Luxury Word Processing, *published by Tab Books.*



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XI.

CIRCLE 198 ON READER SERVICE CARD

GA81

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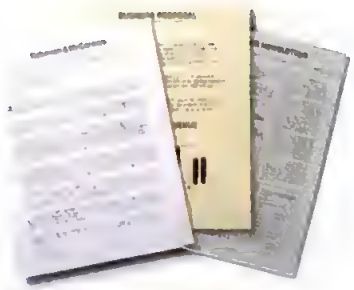
When I first started using the Jet-Setter to print daily reports, memos and budgets, my associates couldn't believe how I instantly gained esteem from top management.

But what really sold them on my talents was when I closed an account the firm had been working on for months with a business presentation printed on—you guessed it—the Jet-Setter.

Now everyone wants to get in on the action. And wait until they find out how affordable Jet-Setters are. They won't even need to purchase any additional software since it's compatible with the HP LaserJet™ series and uses optional Diablo™ and Epson™ emulation cartridges.

Anyone can use it.

My secretary already has an eye on the Jet-Setter to handle the volume of text generated on WordPerfect™ and other word processing files. And you should have seen the response I got when I presented my quarterly report with eye-opening charts and graphs instead of just numbers. Even our communications manager wants to purchase the Jet-Setter to publish internal newsletters using Ventura Publishing™ or PageMaker,™ desktop publishing packages.



With the C. Itoh Jet-Setter laser printer you can create professional business letters, presentations and newsletters.

The Jet-Setter grows with your business.

As more people catch on to the Jet-Setter revolution in my office, they will discover even more exciting features this printer offers, like its large library of font cartridges and expansion memory for full page graphics at 300 dots per inch. The secret to my success? The Jet-Setter from C. Itoh. How long can you afford to be without one of your own?

Helv, 10 point, pro
Roman, 10 point, p
Roman Italic, 10 po
Roman Bold, 10 pol

For the C. Itoh dealer nearest you, call:
Toll-free (800) 423-0300

C.ITOH
C. Itoh Digital Products, Inc.
19300 S. Hamilton Av., Ste. 110 • P.O. Box 9085
Torrance, CA. 90508 • (213) 327-2110

CIRCLE 727 ON READER SERVICE CARD

Today you don't have to pay more than $3,000 for a printer. What will you get if you do?

TAG

Hewlett-Packard revolutionized office printing when it introduced its Laserjet in 1984. The $3,600 HP Laserjet printed 300 dots per inch, producing copy with about two and a half times the resolution of a standard dot matrix printer at a speed of about 8 pages per minute (ppm). It didn't take long for PC users to learn to love the swift, silent machine.

Prices dropped in the intervening years until some models became so cheap they competed with higher-priced letter quality printers. In "Laser Printer Technology: Great Performance for Under $3,000," (*PC Magazine*, Volume 6 Number 8), we gave you an overview of laser printers priced under $3,000. In this issue we take a look at five laser printers priced

from about $3,000 to $5,000 (the NEC Silentwriter LC-850, formerly $2,995, was reduced to $2,195 during our test cycle).

These printers don't just *cost* more—they do more. And they do it with different combinations of features that make them better suited for some applications than for others. This is not a comprehensive review of all machines in the class. Our Fourth Annual PC Printer Project, appearing in Volume 6, Number 19, will give you that. Until then, this review should give you a good idea of what the mid-priced laser printer market presently offers.

These printers—the NEC Silentwriter LC-850, the Genicom 5010, the Quad-Laser I, the Kyocera F-2010, and the AST TurboLaser—have a number of improvements over the original low-cost models: longer duty cycles, faster print speed, more fonts and memory, more input bins, better emulation, lower supply costs, and easier use.

DUTY CYCLE The most important and, often, the most overlooked feature in a laser printer is its "rated duty cycle." Basically, this is a number that tells how long the machine will operate before it quits. You won't find this rating on the box or in the documentation. You'll have to get it the way we did—by calling the manufacturer. For example, the Canon LPB-CX engine—used in the original HP Laserjets, the QMS Kiss, and the Apple LaserWriter—had a rated duty cycle of 100,000 pages. This meant that if you printed 3,000 pages a month, you would have a large doorstop before 3 years were up. With the advent of networks and connectivity features in the PC—making it necessary for office laser printers to serve more and more masters—rated duty cycles have become more important.

Manufacturers of the laser printers reviewed here claim duty cycles three to six times that of the Canon LPB-CX engine, making them capable of producing 5,000 pages a month for 5 years or longer. We did not test these claims, and do not know whether the numbers are cautiously conservative or enthusiastically optimistic. It would be wise to weigh them against the reputations of the companies. However, they do represent a significant improvement over older, lower-cost models.

Laser Printers: Summary of Features

(Products listed in ascending price order)

	NEC Silentwriter LC-850	HP Laserjet Series II	Genicom 5010*	Quad-Laser I	Kyocera F-2010	AST TurboLaser
List price	$2,195	$2,495	$3,695†	$4,495	$4,695	$4,995
Standard RAM	256K	512K	512K	2 Mbytes	1.5 Mbytes	2 Mbytes
Parallel port	●	●	●	●	●	○
Serial port	●	●	●	● (optional)	●	○
Proprietary interface	○	○	○	○	○	●‡
Toner cartridge/developer§	●	●	●	●	●	●
Print image drum or photoconductor cartridge	●	●	●	●	●	●
Engine	NEC	Canon SX	Hitachi	Ricoh 4081	Kyocera	Ricoh 4081
Weight (lbs.)	68	50	84	81.5	68.2	81.5
FONTS						
No. of built-in fonts‖	4	6	6	4	36	1
No. on disk	0	0	0	71	0	80
No. of font cartridge slots	2	2	2	0	2	0
PERSONALITY/EMULATIONS						
Built-in modules	●	○	●	●	●	○
Slide-in modules	○	○	○	○	○	○
Downloaded modules	○	○	○	●	○	●
Epson FX-80	○	○	○	●	●	●
Epson MX-80	○	○	○	○	○	●
IBM Graphics Printer	○	○	○	○	●	●
IBM Proprinter	●	○	○	●	○	○
Diablo 630	○	○	○	○	●	●
HP Laserjet	○	●	●	●	●	○
HP Laserjet Plus	○	●	●	●	●	○
Qume Sprint 11	○	○	○	○	●	○
Other	NEC 3550	None	None	Qume Sprint 5	NEC 3550	HPGL plotter
PERFORMANCE						
Rated pages per minute	8	8	10	8	10	8
Tested pages per minute	7.6	7.5	8.5	7.5	6.7	7.5
Rated machine life (pages)	600,000	Info. not available	Indefinite	600,000	300,000	600,000
Rated life before overhaul (pages)	300,000	Info. not available	300,000	No overhaul	300,000	No overhaul
Rated duty cycle per month (pages)	5,000	5,000	15,000	10,000	5,000	10,000

	NEC Silentwriter LC-850	HP Laserjet Series II	Genicom 5010*	Quad-Laser I	Kyocera F-2010	AST TurboLaser
PAPER HANDLING						
Correct-order output capacity (pages)	250	100	200	250	150	250
Face-up output capacity (pages)	50 (optional)	None	None	None	No tray available	None
No. of paper trays/capacity	1/250	1/200	1/200	1/250	2/250	1/250
Manual feed	●	●	●	○	●	○
Paper path	One turn or straight	One turn or straight	One turn or two turns	One turn	One turn or straight	One turn
OPTIONS						
Memory	1.25 Mbytes	1 Mbyte 2 Mbytes 4 Mbytes	1.3 Mbytes	None	None	None
List price	$660	$495–$1,995	$699	N/A	N/A	N/A
Additional input tray/capacity	1/250 ($255)	None	1/50 ($149)	None	None	None
Face-up output tray/capacity	1/50 ($85)	None	None	None	None	None
Collator	○	○	○	○	● ($600)	○
TONER CARTRIDGE						
List price	$20	Included with print drum	$59.50	$45	$29.95	$48
Life (pages)	3,000	4,000	5,000	3,000	3,000	2,500
PRINT DRUM						
List price	$110	$119	$359	$180	$149.95	$180
Life (pages)	7,000	4,000	30,000	10,000	10,000	10,000
OTHER CONSUMABLES						
Developer	○	○	● ($199)	○	● ($159.95)	○
Life (pages)	N/A	N/A	30,000	N/A	50,000	N/A
Est. cost/page per 300,000 sheets (excluding paper cost)	$0.02	$0.03	$0.03	$0.03	$0.03	$0.04
FONT CARTRIDGES						
No. available	13	23	6	No font slots	2	No font slots
List price	$170	$150–$330	$175	N/A	$150	N/A

●—Yes

○—No

N/A—Not applicable; feature not available.

*HP emulation module tested.

[1] With HP Laserjet Plus emulation; $3,495 with IBM/Diablo emulation.

[8] Can be configured to appear as parallel or serial port

[9] Toner and drum in single cartridge

[11] Can also define additional fonts with internal definitions.

Some of these printers cater to the PC user's lust for speed by stepping up the output. The Genicom and the Kyocera have rated outputs of 10 ppm. In our tests the Genicom produced 8.5 ppm the Kyocera produced 6.7. Of the others, rated at 8 ppm, the NEC Silentwriter LC-850 printed 7.6 ppm and the others produced pages at 7.5 ppm.

Where the original Laserjet had two resident fonts, the new HP Laserjet Series II comes with six. Others in our review have more than 70, one, the Kyocera, offers an almost limitless assortment. As manufacturers added fonts, they added memory. They had to. Laser printers require memory to store downloaded fonts and to compose the page before it is printed. Bit-mapped graphics tend to eat up lots of RAM.

The original Laserjet had a paltry 128K bytes of RAM, but now the new Series II comes with a half a megabyte that can be expanded to a full 4 megabytes. The machines in this review come with as much as 2 megabytes of RAM as a standard feature.

MULTIPLE BINS Paper handling is also a concern to users. Do the printers stack copies face down so that the pages come out in proper order? Each one in our review did. They also either come with two trays as a standard feature (one for letterhead, another for the following sheets) or offered the second as an option. All handled thick, report-cover stock, but only those with a straight-through paper path could print on it without curling the pages. Envelopes also wrinkled less in machines with a straight-through paper path. However, printers with manual feed slots handled single envelopes and strips of mailing labels better than those without manual feed slots.

Another useful feature is the printer's ability to emulate one or more standard printers. Those might include popular dot matrix printers like the Epson FX series and the IBM Proprinters; daisy wheel printers like the Diablo 630, Qume Sprint, and NEC Spinwriter 3550; and the laser printer standard, the HP Laserjet. Since many programs already support these printers, emulation makes it easier for a user to set up a laser printer. All of the

AST's $4,995 TurboLaser has no parallel or serial interface but uses a proprietary connection that hooks to a controller card in the PC. The printer comes with 80 fonts.

printers reviewed here offer at least one emulation as a standard feature. Most offer more.

Separate toner and drums, more-durable components, and more-efficient systems in these machines have reduced the cost per page. The calculations we present in our features table are based on list prices and manufacturers' specifications. The results you get may vary according to the print density per page.

Complex features make these machines more costly than the ones we reviewed in Volume 6 Number 8. However, these features make them simpler and easier to use than their predecessors. The original Laserjet had a front panel with five buttons, four indicator lights, and a two-digit display; the new machines communicate with lines of LCDs, more buttons, and more indicators to point out settings and errors. One of the machines, the Kyocera, will even let you know when it is "thinking."

Nice enhancements, but remember your needs before making a purchase. Printer buttons are not a practical solution if you need multiple fonts on a page. And, if you select a proportional font, your software must know how to use it to produce an attractive result. The bottom line is that many of these features are still best handled through software, making emulation and software support more attractive features than front panel controls.

Photographs: Thom O'Connor

AST RESEARCH INC.

AST TurboLaser

The AST TurboLaser, from AST Research Inc., is a curious combination of the familiar and the unusual, the simple and the complex.

Like the QuadLaser, the AST TurboLaser uses the Ricoh LP4081 print engine. (Our review model had a 4080 engine, but an AST representative said that the machines are now being shipped with the 4081—a minor point, since the models are essentially identical.) Instead of using a parallel or serial interface, however, the printer relies on a proprietary connection that hooks to a controller card in the PC.

You can configure the controller card to look like any DOS-addressable parallel or serial port, which helps avoid conflicts with other installed devices and ports. The toner and drum installation is easy, although the pull-out drawer design of the Ricoh engine does sometimes lead to loose toner. Like the QuadLaser, the TurboLaser lets you create a test print page by taking the printer off-line and pressing the test button at the back of the printer. The results of the TurboLaser test print are nearly useless, however; all you get is a full page of small dots.

More useful is a test print file that uses proportional fonts to print a full-page message from AST, including a logo at the top. But to make this work, you need to send the printer a complex series of commands that downloads the correct emulation and fonts. AST provides a series of batch files to make the process easier, but it takes some study to learn how to do it for yourself.

At the heart of this problem is the basic design philosophy of the whole machine. AST apparently has decided not to put any more intelligence into the printer than is absolutely necessary, and to put all the fonts and features under as much software control as possible. Consequently almost everything you do—whether it's selecting an emulation mode or making a font available—requires a downloaded command.

The printer comes with a range of emulation modes and there is software to emulate the IBM Graphics and Matrix printers,

PC MAGAZINE FACT FILE

AST TurboLaser
AST Research Inc.
2121 Alton Ave.
Irvine, CA 92714
(714) 863-1480
List Price: $4,995
Dimensions (HWD): 23.2 by 20.9 by 14.5 in.
Weight: 81.5 lbs.
In Short: A laser printer that uses the older Ricoh LP4081 engine. It has a powerful yet complex proprietary interface system that uses a controller card.

CIRCLE 685 ON READER SERVICE CARD

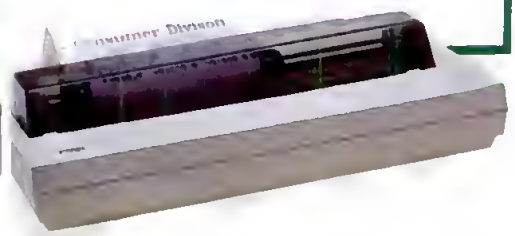
Print Master lets people share printers

Get the most out of your expensive resources—your people, your computers and your printers—with Print Master by BayTech. Not only does it let your people and computers share all of your printers, its buffer keeps them working instead of waiting.

Easy to set up, easy to use

Initial setup is menu-prompted and allows you to configure Print Master to your application. You decide which ports are input and which are output. You also set such functions as baud rates, handshaking, timeout, how you select a printer, etc.

After setup, you simply cable Print Master between your computers and printers, and you're ready to go. BayTech's Memory Resident Program lets your PC users select printers via function keys that correspond to a menu window.



Print Master keeps everything running

All users can send data simultaneously to Print Master's dynamically allocated buffer, keeping your people and computers working. This first-in-first-out buffer also sends data to all printers simultaneously to keep them running at full capacity. The buffer size? A big 512K that's expandable to one megabyte.

Eleven models with serial and parallel

An advantage of Print Master is its flexibility: Any port can be a computer port or a printer port. Choose from eleven models with different combinations of serial and parallel ports. Print Master internally converts serial to parallel and vice versa on combination serial/parallel models. Six ports, $795. Eight ports, $895. Ten ports, $995.

Non-buffered models from $339. GSA pricing available.

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Bay Saint Louis, Mississippi 39520
Telex 910-333-1618 BAYTECH
Phone 601-467-8231 or
800-523-2702

CIRCLE 214 ON READER SERVICE CARD

■ The AST TurboLaser is a curious combination of the familiar and the unusual.

the Epson MX, RX, and FX series, and the Diablo 630. We had some problems when testing these modes with the PC Labs printer benchmark tests. The Diablo mode would not recognize the page eject command after a test page, and the Epson mode put extra lines in the text test. On the graphics test, the Epson FX-85 mode put extra blank lines in the regular-resolution graphic but spaced correctly for the high-res test. In both the Epson and IBM Graphics modes, the printer cut off the left edge of the graphic even when it was clearly in the printable part of the page.

One attractive emulation mode offered by the AST TurboLaser is HPGL mode, which is the language of choice in large HP and IBM plotters. In this case it works with the HP 7475. Oddly, it is not a feature on Hewlett-Packard's own Laserjet Series II. The TurboLaser can emulate any of seven different plotters.

The TurboLaser comes with 80 fonts, but Courier is resident without downloading. Spacing was good on the proportional fonts but the thinner portions of some characters were not connected, making the overall quality of the printed page somewhat less attractive than that of the other four printers in this review.

Like other Ricoh LP4081–based printers, the TurboLaser has only one input tray, no manual feed, and only face-down, correct-order paper output. The printer did manage heavy report-cover stock and labels, but I had no success feeding envelopes: they would either jam or just not feed at all.

The TurboLaser has its own command language, including graphics primitives, that allows you to create figures. The manual includes an explanation of the downloadable font format so that you can create your own font files for custom characters. The documentation is generally denser than most, but the manuals contain some valuable details about how you can program the printer.

The TurboLaser has some interesting and powerful features, but none are so compelling that they justify its higher cost. According to AST, the proprietary interface should make graphics printing faster, but it appears to have made no difference for text print speed. Given the uneven results of some of the emulation compatibility tests, you will want to make certain, before you buy, that your software will work properly with this printer.

GENICOM CORP.

Genicom 5010

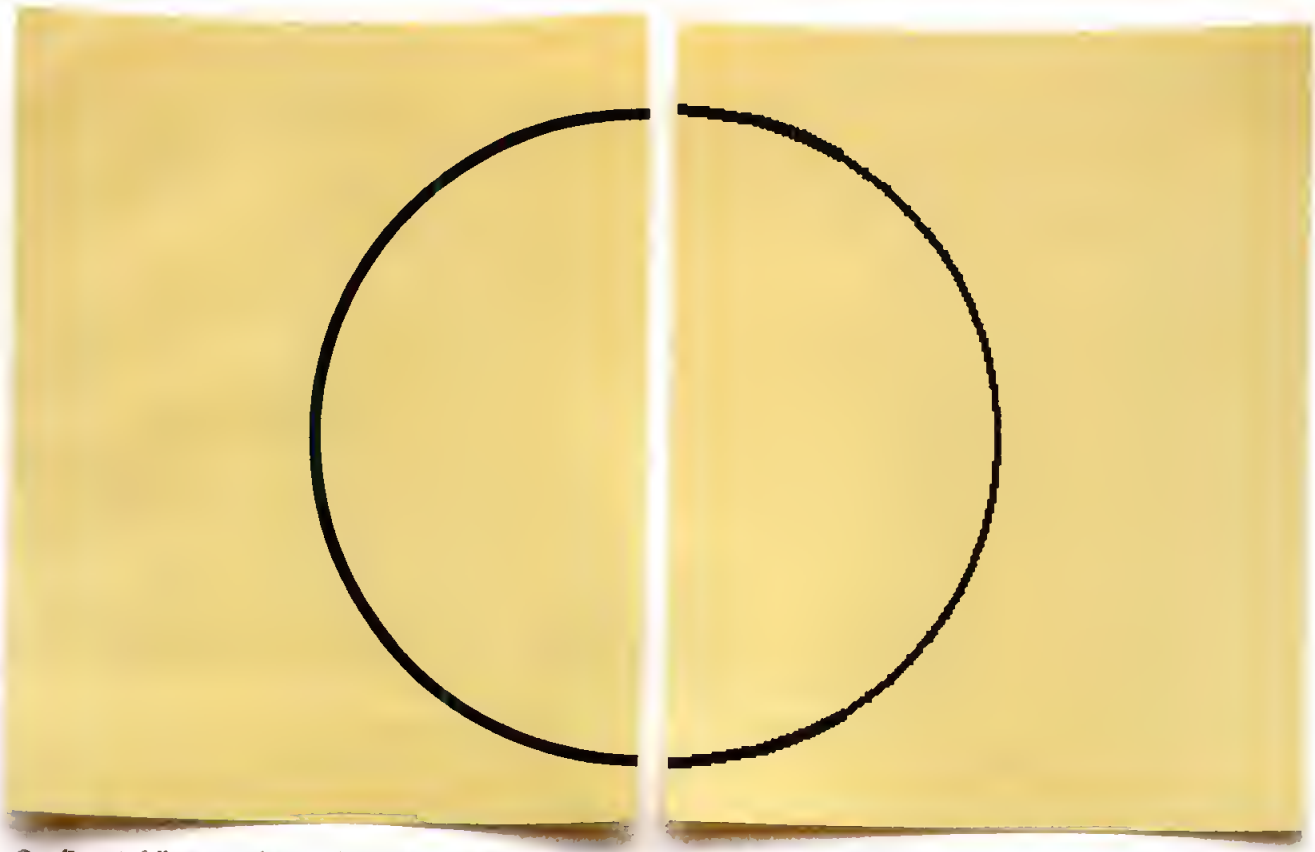
With an internal paper tray and an output tray nested atop its frame, Genicom Corp.'s Genicom 5010 has the smallest footprint and is the most compact of the printers included in this review. It is also the tallest, fastest, most complex. Moreover, its print engine can be replaced when it's exhausted, giving it an indefinite life.

The Genicom 5010 uses the Hitachi print engine, which is harder to manipulate than some other designs. To change the $359 drum (something you must do every 30,000 pages), you must unlock the drum shaft retainer, remove the drum shaft, open the top cover, lift the drum off its conical locator pins, and then clear and remove the toner collection bottle from the used drum assembly. It sounds more difficult than it is, but it's still tougher than the slide-in-the-cartridge-until-it-clicks-in-place varieties. The printer's separate developer unit must also be changed every 30,000 pages.

The 5010 has a useful self-test printout that you can order up from the front-panel buttons. It tells you what emulation is active and how much memory is available, prints a diagram showing the current printer switch settings including those that are

The drum on the $3,695 Genicom 5010's Hitachi print engine must be replaced every 30,000 copies, but ability to give the machine an indefinite life.

QuadLaser™ draws circles around the competition.



QuadLaser's full page resolution of 300 dpi creates graphics that give you smooth curves and sharp detail.

The competition's full page resolution creates images that look jagged.

QuadLaser looks better than the competition. Here's why:

With QuadLaser, circles look like circles, not jagged lines. And solid areas look black, not dull gray.

BLACK!

BLACK?

QuadLaser looks better than the competition because QuadLaser comes with 2 megabytes of memory. That means you get sharp, crisp images every time.

Plus QuadLaser comes with 70 type fonts which can be printed in portrait and landscape. And to ensure full software compatibility QuadLaser emulates Epson, Qume, and HP LaserJet printers.

QuadLaser lasts longer than the competition. Here's why:

QuadLaser's durable design supports a 10,000 page per month duty cycle and a 600,000 page engine life. That's over three times better than the competition's promise of only 180,000 pages.

For increased productivity, QuadLaser features 8 original pages per minute printing, 250 sheet input and output capacity, face down collating, and over 500K of buffer space.

The competition? It can't compare.

MANUFACTURERS' ENGINE LIFE RATINGS

For more information contact us at One Quad Way, Norcross, Georgia, 30093. Or call 404-564-5566.

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An Intelligent Systems Company

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CIRCLE 248 ON READER SERVICE CARD

The PC Magazine Printer Guide

■ The Genicom 5010 can rotate a font on demand with its rotate page button.

not used, lists all available fonts, and prints a full sample of the characters in the fonts.

From the front panel you can also activate the tray select, rotate page, form overlay, paper size, select font, character-spacing, and line-spacing buttons. The form overlay feature allows you to download and activate a form definition.

Most printers must have separate portrait and landscape versions of a font, but the 5010 can rotate the font on demand with its rotate page button. This effectively doubles the three fonts that come with the printer—Courier 10 pitch, Prestige 12 pitch, and Gothic 16.6 pitch. The high-order characters designate foreign language letters rather than PC graphics characters. Additionally, Genicom offers six different font cartridges with a variety of typefaces. PC Labs tested Genicom's $175 version of Hewlett-Packard's B cartridge and found it produced a perfect imitation of HP B's horrible spacing.

Although the toner produced a strong

PC MAGAZINE FACT FILE

Genicom 5010
Genicom Corp.
Genicom Dr.
Waynesboro, VA 22980-1999
(800) 437-7468
(703) 949-1000
List Price: $3,695 (HP emulation, as tested); $3,495 (IBM/Diablo emulation, not tested).
Dimensions (HWD): 24.2 by 18 by 15.5 in.
Weight: 84 lbs.
In Short: A fast, powerful printer with a complex engine and a roundabout paper path that can wrinkle envelopes. It has few resident fonts, but a wide range is available through cartridges.

CIRCLE 684 ON READER SERVICE CARD

PC LABS

PC Magazine's Printer Guide provides data pertinent to your printer purchasing decisions. The results come from PC Labs benchmark tests and hands-on evaluations.

PRINT QUALITY

To allow you to judge text and graphics print quality, text samples are shown both in their actual size and enlarged four times. The graphics sample—the *PC Magazine* logo—was created with a program custom-designed by Decision Resources of Westport, Connecticut.

PC MAGAZINE

SPEED

Rated speeds were obtained from the manufacturer. Default refers to tested speed in draft mode.

TYPE PITCHES

To give you a point of reference, 10 characters per inch is typical pica type, 12 cpi is typical elite, and 17 cpi is typical condensed mode.

FEATURES

Listings of each printer's printing and formatting features tell you how far beyond plain-vanilla printing it will go.

PRINTING FEATURES

H Horizontal emphasis (bold)
V Vertical emphasis (double strike)
U Underline
S Sub/superscript

FORMATTING FEATURES

P Proportional spacing
J Justified lines
C Centered lines
LH Variable line heights
FL Variable form lengths
HT Horizontal tabs
VT Vertical tabs

COMPATIBILITY

The Printer Guide reports on each printer's character compatibility with IBM's low (ASCII code 0-127) and high (ASCII code 128-255) order character set. Low-order characters represent the letters, numbers, and symbols found on the keyboard. The high-order IBM display characters include some line- and box-drawing characters that are useful for nongraphics drawing programs.

Low-order characters ▼ High-order characters ▲

If your printer emulates (is compatible with) the text or graphics of a printer that your applications program supports, you'll have no trouble printing your output. We've tested for each printer's emulation of many of the more-common printers.

Laser Printers

(Products listed in ascending price order)

	TYPE CARRIAGE WIDTH PRICE	SPEED: Pages per minute	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	COMPATIBILITY: IBM character set Graphics Text
NEC Silentwriter LC-850	Laser 8.5 in. $2,195	8.0 rated 7.6 default	10.0 12.0	H V U S P J LH FL HT VT	 IBM Proprinter NEC 3550
HP Laserjet Series II	Laser 8.5 in. $2,495	8.0 rated 7.5 default	10.0 16.6	H V U S P J LH FL HT VT	 HP Laserjet, all models HP Laserjet, all models
Genicom 5010	Laser 8.5 in. $3,495	10.0 rated 7.5 default	10.0 12.0 16.6	H V U S P J LH FL HT VT	 HP Laserjet Plus HP Laserjet Plus
QuadLaser I	Laser 8.5 in. $4,495	8.0 rated 7.5 default	10.0	H V U S P J LH FL HT VT	 IBM Proprinter, Epson FX-80, HP Laserjet Plus Epson FX-80, HP Laserjet Plus, Qume Sprint 5
Kyocera F-2010	Laser 8.5 in. $4,695	10.0 rated 6.7 default	6.0 7.0 7.2 8.0 10.0 12.0 14.4	H V U, 19 S soft fonts included P J LH FL HT VT	 IBM Graphics, Epson FX-80, HP Laserjet Plus Diablo 630, NEC Spinwriter, Qume Sprint 11
AST TurboLaser	Laser 8.5 in. $4,995	8.0 rated 7.5 default	12.0	H V U, 80 S soft fonts included P J LH FL HT VT	 IBM Graphics; Epson FX, RX, MX; Diablo 630 IBM Graphics; Epson FX, RX, MX; HPGL

We understand

✓ **denotes IBM-AT compatibility.**
★ **denotes IBM-PCjr compatibility.**
CP—copy-protected; **NCP**—not copy-protected

SOFTWARE

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✓Alpha/three 1.0 *(DB3 file compatible)* ... 223.
American Small Business Computers
✓ProDesign II 2.5 *(NCP, low price CAD)* ... 169.
Ansa ... NCP
✓Paradox 1.1 *(easy-to-use database)* ... 419.
Application Techniques ... NCP
✓Pizazz 2.0 *(see what your printer is missing)* 49.
Ashton-Tate ... NCP
✓dBase III Plus 1.1 *(the standard)* ... call
✓Framework II 1.1 *(integrated excellence)* ... call
✓Chart-Master 6.21 ... 229.
✓Rapid File 1.0 ... 269.
✓MultiMate Advantage II *(new version)* ... call
Bible Research ... NCP
✓THE WORD 3.1 *(KJV, Bible on Disk)* ... 159.
✓THE WORD 3.1 *(NIV, Bible on Disk)* ... 159.
Borland International ... NCP
★✓Turbo Tutor 2.0 *(learn Turbo Pascal)* ... 24
★✓Turbo Database Toolbox 1.2 ... 41.
✓Turbo Graphix Toolbox 1.0 ... 41.
✓Numerical Methods Toolbox 1.0 ... 59.
✓Turbo Lightning 1.0 *(speller, thesaurus)* ... 59
✓Eureka 1.0 ... 59
✓Turbo C 1.0 ... 59
✓Turbo BASIC 1.0 ... 59
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★✓Turbo Pascal w/Turbo Tutor ... 75.
✓Turbo Prolog 1.1 ... 59
✓Turbo Prolog Toolbox 1.0 ... 59.
✓Turbo Jumbo Pack ... 169.
★✓Sidekick 1.5 ... 51.
★✓Traveling Sidekick 1.0 ... 43.
✓Reflex 1.1 ... 87.
✓Reflex Workshop 1.0 ... 41.
★✓Superkey 1.1 ... 59.
Breakthrough ... NCP
✓Timeline 2.0 *(project management)* ... 259
Broderbund ... CP
★✓Print Shop *(banners, signs, etc.)* ... 35.
★✓Print Shop Companion *(tools for PS)* ... 33.
★✓Graphics Library 1 or 2 ... 22.
Computer Associates ... NCP
✓Spreadsheet Auditor 3.0 *(check your work)* 89.
✓SuperCalc 4 1.1 *(includes Sideways)* ... 299.
Core International ... NCP
✓Corefast 1.2 ... 89.
Crosstalk Communications ... NCP
★✓Crosstalk XVI 3.61 ... 95.
✓Remote 1.3 ... 95.
Dac Software ... NCP
✓Dac Easy Base ... 32.
✓Dac Easy Payroll 2.0 ... 32.
★✓Dac Easy Accounting 2.0 ... 45.
Daybreak Technologies ... NCP
✓Silk 1.0 *(advanced features)* ... special
Digital Research ... NCP
✓Gem Draw Plus 2.0 ... 189.
Executive Systems ... NCP
✓XTREE 2.0 *(DOS shell)* ... 31.
5th Generation ... NCP
✓Fastback 5.14 *(quick, reliable)* ... 89.
Generic Software ... NCP
✓Generic CADD 3.0 *(full-featured)* ... 69
✓Auto Dimensioning 3.0 ... 35.
✓Dot Plot 3.0 ... 35.
Hilgraeve Software ... NCP
✓HyperAccess 3.2 ... 89.
Harvard Associates ... NCP
★✓PC LOGO 2.0 ... 89.
Hayes ... NCP
✓Smartcom II 2.1 ... 89
Infocom ... NCP
✓Cornerstone 5.2 *(powerful database)* ... 59.
Intersecting Concepts ... NCP
✓Backup Master 2.0 ... 59.
Javelin Software ... NCP
✓Javelin 1.1 *(more than a spreadsheet)* ... 69.
Lifetree ... NCP
✓Volkswriter Deluxe Plus 1.0 *(an old favorite)* $69.
✓Volkswriter 3 1.0 ... 147.
Micro Education (MECA) ... CP
✓Managing Your Money 3.0 ... 115.
Micropro ... NCP
✓WordStar Professional Release 4.0 ... 259.
✓WordStar 2000 Plus Release 2 ... 229.
Microrim ... NCP
✓R:base System V 1.1 *(with Express)* ... 429.
✓R:base Graphics 1.0 ... 159.
Microsoft ... NCP
✓Windows 1.04 *(incl. Write & Draw)* ... 65.
✓Multiplan 3.01 ... 119.
✓Chart 2.02 ... 189.
✓Word 3.11 *(graphics based)* ... 229.
✓Project 3.01 ... 239.
LANGUAGES
✓Quick Basic 3.0 *(newest version)* ... 59.
✓Macro Assembler 4.0 ... 97.
✓FORTRAN Compiler 4.0 ... 289.
✓C Compiler 4.0 ... 279.
Monogram ... NCP
✓Dollars & Sense 3.0 ... 105.
Nantucket Software ... NCP
✓Clipper *(Autumn '86, dB3 Plus compiler)* 399.
Nolo Press ... NCP
★✓WillWriter 1.0 ... 35.
Paul Mace ... NCP
✓H/Test-H/Format 1.0 *(hard-disk tools)* ... 49.
✓Mace Utilities 4.0 *(DOS utilities)* ... 59.
Paperback Software ... CP
✓VP-Planner 1.3 *(1-2-3 compatible)* ... 57
✓VP-Info 1.0 ... 57.
✓VP-Expert 1.0 *(expert system)* ... 57.
Personics ... NCP
✓SmartNotes 2.0 *(Post-It-like notes)* ... 49.
✓SeeMORE 1.0 ... 49.
Quarterdeck ... NCP
✓DESQView 2.0 *(operating environment)* ... 79.
Simon & Schuster ... NCP
★✓Webster's New World Speller 1.3 ... 39.
★✓Webster's New World Thesaurus 1.07 ... 43
✓Webster's New World Writer 1.04 ... 59.
Softlogic Solutions ... NCP
✓Double DOS 4.0 ... 35.
✓Software Carousel 2.0 *(everything resident)* 35.
✓Disk Optimizer 2.01 *(speeds up HD)* ... 35.
Software Publishing ... NCP
✓PFS:Personal Publisher 1.0 ... 89.
✓PFS:First Choice 1.0 *(integrated)* ... 109.
✓PFS:Professional Write 1.0 ... 119.
✓PFS:Professional File 1.0 ... 149.
✓PFS:Professional Plan 1.0 ... 149.
✓Harvard Presentation Graphics A:02 ... 239.
✓Harvard Total Project Manager 2.0 ... 349.
✓Harvard Professional Publisher 1.0 ... 409.
Springboard ... CP
✓Newsroom *(make your own newspaper)* ... 35.
✓Certificate Maker *(NCP)* ... 34.
✓Newsroom•Pro *(NCP)* ... 79.
Symantec ... NCP
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- ★ Diamond *(6 outlets)* ..... 29.
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- FX-286e *(136 col., 200 cps)* 479
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- 10 Meg cartridge . . . 57
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- AT 360k Drive *(5¼" half-height)* . . . 117

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- Maxell *(10 disks per box)* . . . 27

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black image, it sometimes left gray spots in large black areas. The 5010 has no straight-through paper path. Instead, the paper follows an S-path and the manual feed follows a C-path that wrinkles envelopes and other items. At times, too, the printer would not reprint a page that jammed—a quirk that could cause frustrating problems if paper jammed in the middle of a long print run.

The Genicom 5010 offers a choice of HP Laserjet Plus and Diablo 630/IBM Graphics printer emulation contained in the personality module that is part of the printer interface. The interface includes parallel and serial connections. In our tests the HP module performed without a hitch.

Despite its complexity, the 5010 is compact and well-built and, in our test, printed 8.5 ppm—almost a full ppm faster than the next-fastest printer in this review.

The $4,695 Kyocera F-2010 lets you custom-design the appearance of letters—one of its many features. Also included are two paper trays.

KYOCERA CORP.

Kyocera F-2010

If the Kyocera F-2010 were a car, it would be one of those Japanese models with an automatic sun roof, power side mirrors and switch-adjustable shocks, all standard. This laser printer does everything but talk to you—so maybe it's not quite like a Japanese car.

Setup is straightforward. You slide in the drum cartridge and load a toner cartridge in the top of the printer. The printer uses Kyocera's own laser print engine and has a separate developer module that must be replaced after 30,000 pages.

There are two input paper trays, and the paper can be routed to either a face-down, correct-order tray on top, or to a face-up tray that uses a straight-through paper path. There is also a manual feed slot for transparencies, envelopes, and other unusual printing surfaces. The printer did a good job on heavy paper stock and envelopes, especially when I used the straight-through path, but I encountered a few jams from the manual slot even with standard-weight paper.

Once you load the paper, you can produce a status report: one page that lists the current settings, the amount of available memory and how it has been allocated, and the status of 34 different printer settings. Almost all of these items (plus others) can be set with the comprehensive controls on the printer's front panel.

The front panel has 14 buttons and a 10-key numeric pad. These can be used to select the font, adjust margins, choose an emulation mode, eject a page, and more. Pressing the font button repeatedly, for example, will cause the printer to scroll through the fonts that are available.

The choices appear on the printer's backlit LCD message display. The display is mounted at an angle, but unfortunately you cannot read the letters if you are at the same level or directly above the display. A small angle adjustment, similar to those on many laptop displays, would be a welcome improvement.

When you're ready to select a font, pressing the mode select button on the front panel brings up a number of alternatives—for example, "font sample?", which will print a test page showing samples of the 36 resident fonts. These fonts include standards such as Courier, Prestige, Times Roman, and Helvetica in a variety of sizes, weights, and angles. The letters are well-designed, with good spacing on the proportional fonts.

In the unlikely event that you do not find just what you want in a resident font, you can use the GENF command—one of many available that work directly with the printer's controller (no extra software required). GENF will generate and download fonts created to your specifications. The printer has five different font templates to work with, and you may choose

PC MAGAZINE FACT FILE

Kyocera F-2010
Kyocera Corp.
3165 Adeline St.
Berkeley, CA 94073
(800) 367-7437
(415) 848-6680
List Price: $4,695
Dimensions (HWD): 17 by 35.5 by 14.5 in.
Weight: 68.2 lbs.
In Short: Slower than its rating would suggest, the Kyocera has lots of features, but its time-out feature and often obscure front panel can be bothersome. Its strength lies in its range of emulations and its built-in font definition feature.

CIRCLE 683 ON READER SERVICE CARD

size, weight, orientation, and even have the letters printed upside down.

Other F-2010 commands let you design custom characters, create bar codes, and draw figures using graphics primitives. We used these commands to produce the test pattern noted in the manual—a bull's eye and arrow drawing that features the commands used to produce the drawing.

The Kyocera comes with a full range of emulation modes. We tested the IBM Graphics, Epson FX-80, Diablo 630, and HP Laserjet Plus modes. The Diablo 630 mode did not produce bold letters where it was supposed to on the text test, although the graphics tests came out well with only a faint graying of solid bands in the test prints.

Although the manufacturer rates the printer at 10 ppm, the F-2010 turned out to be 6.7 ppm, on the PC Labs speed benchmark test—nearly a page per minute slower than the 8-ppm printers tested here.

A Kyocera representative said the company's rating was based on multiple repetitions of a single-page document. The PC benchmark test is based on a two-page document.

Kyocera's was the only printer that had a "time-out" feature: it would print a page if it had not received any data within a programmable period of time. This became annoying because the printer would dump a page while I was trying to figure out what commands I was going to try next. The time period can be set from 5 to 495 seconds (8.25 minutes), but it cannot be defeated: it will dump a page at the prescribed default time if you fail to set another. I can see the value of this feature, as well as how it could cause problems.

Although the Kyocera F-2010's standard features offer a great deal of flexibility, the price is steep. Its rated life is not quite as long as that of others in this review.

NEC INFORMATION SYSTEMS INC.

NEC Silentwriter LC-850

NEC Information Systems' Spinwriter has set the pace for years among durable office printers. Now NEC has taken on the laser printer market with its new Silentwriter, a well-equipped, moderately priced machine.

NEC recently moved its mid-priced Silentwriter LC-850 into the low-end market by dropping the price from $2,995 to $2,195. It's a good choice for heavy-duty jobs.

The Silentwriter LC-850 sells for just $2,195—less than half the price of most of the printers in this review. It has a 600,000 page duty cycle—at a manufacturer's estimated use of 5,000 pages per month, which also compares well to the others in this review. It is based on the print engine, designed and built by NEC.

The LC-850 has a separate toner cartridge and drum. The toner comes in a small cartridge that is emptied through an easily accessed slot in the top of the printer. The drum slides into the middle of the machine, which is reached by opening the front half. Like many new print engine designs, the Silentwriter drum is exposed and requires careful handling. It is harder to work with than the Canon LPB-CX engine design in which the toner and drum are in a single cartridge.

It is easy, but time- and paper-consuming, to self test the printer: when you press a sequence of buttons on the front panel display, the Silentwriter will print a "barber pole" page showing the available fonts (including any font cartridges installed). Curiously, it prints ten pages per font before it starts to show the next one. Testing the four standard resident fonts takes 40 pages.

The printer can accept commands for a NEC Spinwriter 3350, and, if you need graphics, you can throw a DIP switch to get IBM Proprinter emulation. The Silentwriter did a decent job with the Proprinter graphics emulation. On the graphics test there were small gaps in the vertical bars for the standard resolution, but the high-resolution test was perfect. Toner used by the Silentwriter produced solid, dark bars.

On the text test, the LC-850 had some trouble emulating the Proprinter. Apparently there are some Proprinter commands

that are not supported; the PC Labs printer benchmark test consistently produced a "paper size" error on the LC-850—although once I pressed the resume button, the pages printed without further delay. This might cause a problem if you are planning to rely on the Proprinter emulation. There is also a line in the test that is too long. Instead of wrapping to the next line as the other printers did, the LC-850 overprinted the character on the same space as the next-to-last character.

The LC-850 comes with only four fonts but allows you to enhance them with shadow, bold, reverse and underline. You can also use the LC-850 command set to produce a Benday screen in four different dot densities behind your text. This command set also offers other features. It allows you, for instance, to magnify characters to twice their height and width.

The resident fonts are based on the standard Courier monospace typeface. The three portrait fonts (upright, italic, and math symbols) are 10 pitch and the single landscape font is 12 pitch. Each is clean and well defined and supports high-order PC graphics characters.

The Silentwriter's printed pages arrived in correct order, face down at the front of the printer. It has a manual feed slot and a well-concealed face-up page output slot for thick paper, labels, and envelopes. These come out looking better if you use the face-up output slot. Although it does not have totally straight-through paper path, it does not require the 180-degree turn used by the top output tray. There is an optional tray available for this slot. The printer had no problem with any of the special papers I fed it. It should be fairly simple to feed envelopes manually by creating settings with a word processor.

The LC-850's front panel provides a two-line, 16-character LCD message panel, and four clearly labeled buttons for selecting fonts, manual feed, forms override (page eject), and pause/continue. It was the least expensive of the printers in our review, but ranked second in speed. It has only 256K bytes of memory (although NEC offers a 1.25 megabyte memory expansion option for $660), which limits its ability to do graphics but makes it a great buy for those who need a heavy duty text printer more than they need one with fancy fonts and illustrations.

PC MAGAZINE FACT FILE

NEC Silentwriter LC-850
NEC Information Systems Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000
List Price: $2,195
Dimensions (HWD): 24 by 18.5 by 15.25 in.
Weight: 68 lbs
In Short: Once priced to compete with others reviewed here, the fast, durable NEC LC-850 takes on the low-end market with its recent price cut. It is short on features but well suited for heavy production of straightforward typed material. The 1.25 megabyte memory expansion option is priced at $660.
CIRCLE **682** ON READER SERVICE CARD

QUADRAM CORP.
QuadLaser I

Quadram Corp.'s, $4,495 QuadLaser I adds a wide range of fonts and emulation features to a fairly standard print engine. It achieves power and flexibility in some areas, but encounters limitations in others.

The print engine is the Ricoh LP4081, which is almost as common in laser printers as the Canon LPB-CX. Its separate toner and optical drum components are easy to insert. Toner cartridges come in pairs, and it takes two to give the printer its initial charge. Both load into a bin in a pull-out panel on the front of the printer, and it takes some care to keep a little of the toner

PC MAGAZINE FACT FILE

QuadLaser I
Quadram Corp.
1 Quad Way
Norcross, GA 30093
(404) 923-6666
List Price: $4,495
Dimensions (HWD): 23.2 by 20.9 by 14.5 in.
Weight: 81.5 lbs.
In Short: The QuadLaser depends on a combination of resident features and downloaded software, making it flexible but more difficult to work with than some other printers.
CIRCLE **681** ON READER SERVICE CARD

Quadram's $4,495 QuadLaser I is a durable machine but relies heavily on downloaded fonts and software. One advantage: special drivers for certain programs.

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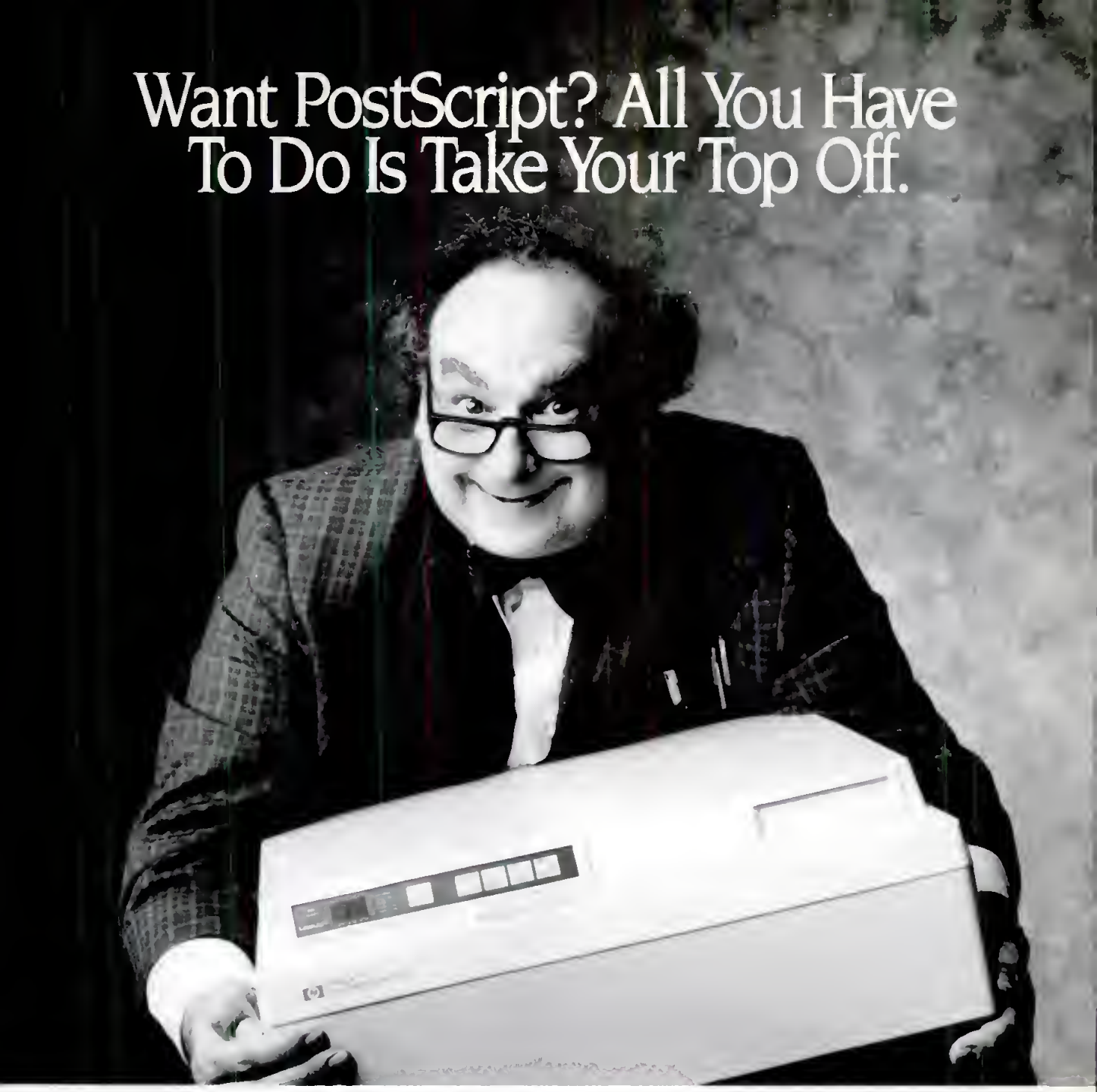

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■ The QuadLaser I is a durable machine that takes a bit more work to use than some others.

from escaping when you load it.

The printer comes with a parallel port, but a serial version is available. There is a single paper tray, but no manual feed slot. After you load the drum, toner, and paper, you just plug in the power and connect the printer to your computer. Where other printers in this review have descriptive front panels, the QuadLaser's has a single button and a series of indicator lights.

To produce a test print sheet, you take the printer off-line and press the test button on the back. The printer produces a single page that lists the amount of available memory, available fonts, and the current emulation mode in the center of the page, surrounded by a border of tiny dots. There are no font samples.

The QuadLaser automatically comes up in Qume Sprint 5 emulation mode, but it is an easy matter to switch modes by using a special command set that Quadram calls the bar commands (because they all begin with "Esc |"). You can use bar commands to select emulation modes, adjust margins, select or download fonts, and control other features. Quadram makes these features more accessible with a number of batch files and a printer configuration utility called QLX.

The Epson FX or MX emulation mode is resident in the printer and can be selected with a bar command, but the HP Laserjet Plus emulation module must be downloaded. The QuadLaser did not produce bold print in the PC Labs benchmark text test in either emulation. The Epson emulation worked when we issued escape commands directly, and bold reproduced properly in the graphics portion of the HP Laserjet Plus emulation. One strong feature of the Ricoh engine is that it produces solid, evenly toned black areas.

The printer comes with two resident fonts, Courier 10 pitch normal and bold, and these can be rotated from portrait to landscape in the Qume mode. The QuadLaser comes with 71 additional fonts that can be downloaded in the different emulation modes. Although they are not in the HP Laserjet Plus format, they are available through a conversion utility.

Although the fonts are fairly good, spacing appeared a bit wide in some of the proportional fonts. The Epson emulation mode gives you access to a dot matrix font that can be expanded, boldfaced, compressed, and modified as it would be on an Epson dot matrix printer. The image is dark, but the characters have the same coarse definition as the Epson character set does.

Characters not on the font can be had by firing up the font editor that Quadram supplies with the printer. Using downloadable fonts, you can modify existing characters by making them bolder or slanted, and you can actually create new characters to print special symbols that you might need. But this can be a slow and tedious process if you are creating many characters.

The QuadLaser handles fonts better than it does paper. There is only one paper tray and no manual feed slot. The single output bin produces face-down, correct-order printouts, but there is no straight-through path for thick or two-layered paper. I was unable to feed an envelope successfully. When running the HP emulation, the printer simply ignored the command to trigger manual feed—understandable since it lacks a manual feed slot—and instead used the paper tray without pausing. This automatic feeding could create a problem with programs that expect you to be able to feed the printer a special type of paper at a certain time.

Although the QuadLaser lacks some of the features its competitors offer, it does make a significant effort to help the user. The manual contains 30 pages of questions and answers, as well as detailed information about using the printer with popular programs. Sample batch files are listed in the manual, and Quadram provides special drivers for certain programs such as *DisplayWrite 3*.

It is a durable machine that takes a bit more work to use than some others. Since so many of its features depend on downloaded fonts and other software, accessing all its features is more difficult than with machines that have these items resident in ROM. There are better values on the market today.

PC MAGAZINE EDITOR'S CHOICE

- There is no clear winner

Each printer reviewed offers something special. The AST, Genicom, Kyocera, and Quadram printers are more durable and often faster than their more-popular, less-expensive competitors. NEC's recent price cut makes the heavy-duty LC-850 competitive in the low-end laser printer market.

Ironically, on a cost-per-page basis, even the more-expensive printers in this review may be cheaper to run despite their expensive up-front purchase price. None, however, can match the print quality of the new $2,495 HP Laserjet Series II. Weigh initial purchase price, operating cost, and print quality, and you'll probably conclude that Hewlett-Packard has the edge for now.

NO LOSERS

All of these machines are built for heavier use than the original HP Laserjet. They offer more forms of emulation and come with more fonts. In general, their expanded front panel features should make them easier to use, and they offer better paper input and output options. In the final analysis, however, they must be compared to Hewlett Packard's new Laserjet Series II and the other low-cost lasers now on the market. Which is better, one durable printer or two "lightweights" that last half as long but cost half as much? Different workplaces will have different requirements, but in general, I expect that most users will find better values among the lower-priced options.

Alfred Poor is a frequent contributor to PC Magazine.

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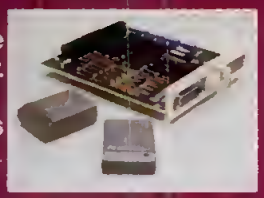
But no matter what you feed the 5010, the result is laser perfect. Whether it's word processing that approaches typeset quality or high resolution graphics, the Genicom 5010 leaves nothing to the imagination.

It's Convertible. With Genicom's uniqua personality cartridgas, the 5010 converts into multiple identities. Like a Diablo® 630, an IBM® Graphics Printer, or a Hewlett-Packard® LaserJat Plus for startars. Changing personalities is easy. Simply plug in a new cartridge. In seconds, the 5010 is up and running with any computer worth mentioning, plus the very latest laser software.



When it comes to print styles, the 5010 converts to your personality. Choose from a variety of fonts. Insert up to four font cartridges at once, and vary type styles within the same document.

Take Command. The 5010's prominent control panel is sophisticated simplicity. Just push a button to select fonts, input cassette, forms overlay, paper size, characters per inch, lines per inch and form feed. Even the 5010's diagnostic readout speaks your language, with a 32 character LCD that informs you of printer status in plain English.

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BEYOND NUMBER CRUNCHING

With a few inside tips and some add-in software products, you can stretch 1-2-3's database management and word processing capabilities and make it act like a truly integrated program.

LOTUS DEVELOPMENT CORP.'S fantastically successful *1-2-3* spreadsheet software is known for its number crunching. Despite a difficult interface that can intimidate novice users, this package tames budgets and statistics for companies large and small. It is much harder, however, to get this "integrated" package to perform database or word processing functions. Many users of *1-2-3* are so put off by the process, in fact, that they settle for number crunching and forget the software's other functions.

As Lotus has demonstrated its commitment to the package over the years, numerous third-party support products have evolved. Some of these programs can ease your database and word processing woes with *1-2-3*; with a little extra work, they can help you solve many problems yourself. The need arises because although *1-2-3* is an acceptable data manipulator, it is difficult to set up and use. It probably wouldn't be anybody's first choice for database applications, but if you now have *1-2-3* for spreadsheets and want to add some simple database activities, it works well enough.

DATABASE MANAGEMENT WITH 1-2-3

The first step is to understand the arrangement of information in a data file application. Unlike a word processing file, where blocks of text are stored and retrieve thousands of characters at a time, data management applications usually work with much smaller pieces of information. The smallest practical unit of information is usually called a *field*. In a name and address file, a person's name might occupy one field, the street address another, and the city, state, ZIP code, and telephone number still another each. Each of these fields is given a *label* to pinpoint each piece of information: for example, the name field, address field, or state field.

The next data division is the *record*. A number of fields combine to form a record of related data. Name, address, city, state, ZIP code, and telephone fields form a name and address record. A group of records forms a *data file*. In some applications, a number of files work together to form a *database* of related subjects.

Lotus's *1-2-3* is designed primarily for handling numeric information in a cell-oriented structure defined by the intersection of a row and column. Although *1-2-3* offers relatively limited commands and procedures for database support when compared with database or data filer software, the row/column arrangement is fairly well suited to database applications. Each spreadsheet cell in the database section holds information for a single field. One row, the horizontal (left-to-right) grouping of individual cells, makes up a record, and all of the rows in the database section of a worksheet are analogous to the conventional data file.

CREATING A DATABASE To create a database in *1-2-3*, enter each field label in a separate column at the top of the designated database area. Each field label will occupy one worksheet cell. If each record is to contain ten fields, you will use ten columns to define the basic record structure. You should also determine the length of each field and adjust the column widths under each field label accordingly. For example, if you determine that 35 characters are required for a name field in column S, use the /Worksheet Column Set command to adjust the width of column S to 35 characters. See Figure 1 for a sample *1-2-3* record structure.

This sample shows a portion of a sales-tracking database with the fields NAME, REGION, and AVG_MO_SALES.

In some ways, filling a *1-2-3* database with information is even easier than with some database software packages. Once you have established the field labels, simply move the highlight cursor into the cell under the appropriate field label and type the entry. Just make sure there is no extraneous information in the first row under the field names—not even blanks. For *1-2-3*'s database features to work properly, the first record must appear in the first row immediately below the field labels. This arrangement of information supports *1-2-3* sorts, data searches, extraction, and reporting functions.

The records in Figure 1 are shown in alphabetical order. You can enter data in random order, then have *1-2-3* put it into order for you. Before you use the sort feature, make sure that the current version of your database is on disk. An error in specifying the sort parameters could mix the database record structure beyond recovery. Next, enter the /Data Sort command. From the sort menu, select the Primary-Key definition. You can select up to two key fields to specify the order of the data records. For example, you can sort by sales region, then sort all of the records within each region by name. Lotus calls these key fields the primary key and secondary key.

After you choose Primary-Key from the menu, move the highlight cursor into one of the records to highlight the field you will use for the primary sort and press Return. To select REGION as the primary key, put the cursor in the first cell under the REGION field label and press Return. Note that you need only specify a single record and field. If a secondary key is desired, select it in the same way.

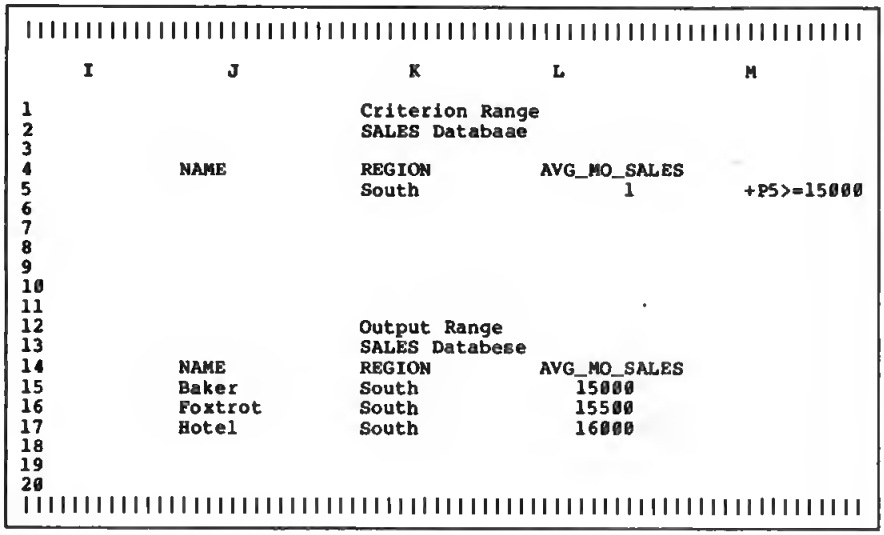
With *1-2-3* you can sort a group of records or the entire database. Select Data-Range from the Sort menu and highlight the sort range, or enter the range of cells that describes the width and depth of your database or the area within your database you want to sort. When you select Go from the Sort menu, *1-2-3* immediately begins

	A	B	C	D
1	Field Labels----->NAME		REGION	AVG_MO_SALES
2	Field Data------->Ackers, John		South	$14,250
3		Baker, Sam	Central	$15,612
4		Chilton, Susan	South	$16,150
5		Dilbert, Franklyn	North East	$13,819
6		Tango, Likado	Central	$ 9,896

Figure 1: *Sample* 1-2-3 *record structure.*

	N	O	P	Q
1		Input Range		
2		SALES Database		
3				
4	NAME	REGION	AVG_MO_SALES	
5	Baker	South	15000	
6	Charles	North	15500	
7	Delta	Central	16000	
8	Echo	West	18000	
9	Foxtrot	South	15500	
10	Golf	North	10000	
11	Hotel	South	16000	
12				
13				

Figure 2: *Sample database Input range.*



	I	J	K	L	M
1			Criterion Range		
2			SALES Databaae		
3					
4		NAME	REGION	AVG_MO_SALES	
5			South	1	+P5>=15000
6					
7					
8					
9					
10					
11					
12			Output Range		
13			SALES Databese		
14		NAME	REGION	AVG_MO_SALES	
15		Baker	South	15000	
16		Foxtrot	South	15500	
17		Hotel	South	16000	
18					
19					
20					

Figure 3: *Criterion and Output ranges.*

the sort. Because the database is stored entirely in RAM, the sort is generally completed quickly, even with large data areas.

After the data is entered and sorted into the desired order, you usually want to extract parts of it in specific ways: a list of everybody in a single sales region, a list of everyone with a monthly sales average above a specified amount, or a list of anyone who has failed to meet a quota. Data extraction in *1-2-3* is handled by establishing a separate area of the worksheet as an Output range and copying selected records to this reporting area. If you need printed reports, use *1-2-3*'s standard /Print Printer command to produce hard copy of the extracted records. Tell *1-2-3* which records to move to the Output range by designing a separate Criterion range in another area of the worksheet.

The Criterion range uses two worksheet rows to specify the search field and the field contents that will be compared against actual database information. Figure 2 shows how the Input range of a small sales database might be arranged. This sample has been sorted in name order. Notice that we have included a two-line title for this worksheet region in cells O1..O2, but the actual Input range is N4..P11. The Input range must include the field labels.

EXTRACTING RECORDS To extract specific records from such a database, establish a Criterion range by using the /Copy command to copy the field labels on which you want to search into another area of the worksheet.

In Figure 3 we have copied all of the field labels of the short sample database to the Criterion range. The Criterion range is contained in worksheet cells J4..L5. A Criterion range looks like a database record, because you use the field labels and the field positions to tell *1-2-3* what information to look for in the database. In this sample we have specified two search criteria: REGION = South and AVG_MO_SALES >= 15000. To specify a label search criterion, such as South, you simply enter the string under the appropriate field label.

As in Figure 3, you can also use worksheet formulas to select specific records. In this sample we have used cell M5 to display the formula used as part of the search criteria in L5. Such a formula displays a 1 or a 0 for true or false; so, to provide additional worksheet documentation, it is a good idea to show the formula as a label by reentering the formula in another cell with a *1-2-3* label prefix. Note that this is a relative formula, so you need to specify only the first cell in the database that points to the first field you want to use for the compare.

As *1-2-3* searches the Input range, it will assume you want to compare all of the relative field positions against this value. This sample Criterion range tells *1-2-3* to search the input area and copy to the Output range any records that have South in the REGION field and a value greater than or equal to 15,000 in the AVG_MO_SALES field. Because the area under the NAME label is blank, *1-2-3* will retrieve all the names in the database, as long as the other criteria are met. A blank field in the Criterion range is like a wildcard that says "get them all."

Two wildcard characters are available to help you find information within a field: a "?" for a single character and an "*" for a series of characters to the end of the field. When *1-2-3* sees a wildcard in a search request, it accepts any character in the worksheet in that position. A search for Print*, for example, will find Printer, Printing, Printer Setup, or Printer Control, but it would not find Controlling the Printer or Setup for Printer.

USING THE OUTPUT RANGE The database Output range is created in the same way as the Criterion range. Use *1-2-3*'s /Copy command to copy the field names you want in the reporting area into a separate worksheet range.

The sample in Figure 3 shows an output range of J14..L14. Notice that you don't have to include all of the fields that appear in the Input range, nor do they have to be in the same order in the output area as in the input area. It is absolutely critical, howev-

```
'Input'      Set the renge conteining date recorda
'Criterion'  Set the renge conteining criteria
'Output'     Set the renge to which extrected records are copied
'Find'       Highlight each record matching criteria
'Extrect'    Copy ell records that match criteria to Output range
'Unique'     Copy all recorda that match criteria to Output renge,
             elimineting duplicetes
'Delete'     Delete all records that match criteria
'Reaet'      Cancel Input, Criterion, and Output rangea
'Quit'       Return to READY mode
```

Figure 4: *Database menu commands.*

er, that the labels appear in the output area precisely as they are entered in the input area. If you enter a space before or after a field label in the output area, for example, but this space doesn't appear in the input area, *1-2-3* won't be able to conduct a proper extract operation. During an Extract operation, *1-2-3* will use as much space below the Output range field labels as necessary to store the found records, so make sure there is no information below the Output range that you may want to keep.

You can restrict the Output range by also specifying a lower limit, but in this case if more records are found than you made space for, the extra records will not be copied into the Output range. Once you have established the three database ranges—Input, Output, and Criterion—you are ready to conduct some reporting operations. Enter the /Data Query command to display the database menu. Figure 4 summarizes the available commands in this menu.

Before you can begin operating on these established data ranges, you must tell *1-2-3* what they are. Select Input, Output, and Criterion from the menu to specify the cell ranges for these worksheet areas. The easiest way to handle this chore is to name the areas using the /Range Name Create command sequence before entering the query menu. To keep things simple, you can name these ranges Input, Output, and Criterion and simply reenter these names in answer to the appropriate /Data Query menu prompt to establish the proper ranges for a search.

If you save the worksheet after these limits have been set, then *1-2-3* will know them the next time you retrieve the worksheet from disk. By entering Find from the /Data Query menu, you can view specified records in the Input range without copying them to the output area. The Extract command copies records that match the criterion specifications to the output area of the worksheet.

THE "GET DATA" MACRO One other *1-2-3* database tip: Use macros. Many *1-2-3* users shy away from writing macros, but these little programs can make worksheet life a lot easier. During a /Data Query operation, for example, to enter new search criteria you have to Quit the menu, enter the new criteria, and enter the /Data Query Extract command again. The simple macro shown in Figure 5 will automate this process.

■ Many *1-2-3* users shy away from writing macros, but these little programs can make worksheet life a lot easier.

It is a good idea to set aside a separate area of the worksheet for macros. Then, as you add new programs, they will all be in the same area. Write the macro in Figure 5 by placing the highlight cursor over the first cell that will contain the macro and enter an apostrophe, *1-2-3*'s label prefix. Then type the /Data Query Extract Quit command sequence: /dqeq. Move the cursor to the next row and enter the {?}~ macro sequence.

The bracketed question mark tells *1-2-3* that you want to enter data from the keyboard. The "~" (tilde) terminates this command and then moves on to the next macro instruction. The final macro statement, {Get_data}, tells *1-2-3* to begin executing the macro Get_Data. The final step in writing this macro is to name the macro range. Place the cursor on the first cell in the macro (/dqeq) and enter the/Range Name Create command. Be sure to name the macro with a single alphabetic character that is preceded by the backslash (\). The backslash tells *1-2-3* that the range is an executable macro. We have called this one \Q for query. Then issue the /Range Name Create command a second time and name the same cell Get_Data. This gives the macro a name that can be called from within the macro.

To start the macro, place the cursor within the Criterion range and press Alt-Q. *1-2-3* will extract from the database area (Input range) any records that match your criterion specifications, then exit the Data Query menu to await changes to the criterion specifications. The status indicator in the upper-right-hand corner of the screen will indicate Ready, and you can enter virtually any worksheet data or command sequence. When you want to extract another set of data, simply press Return. The macro will execute again and will return you to the Ready mode. Enter Ctrl-Break to halt macro execution. Note that this macro is written for users of Release 2.0 or later. If you are using Release 1A, replace the final macro statement with

```
/XGGet_Data~
```

Although potentially complex, macros can be written to display *1-2-3* database data in a full-screen format, one record at a time. You can create a data entry screen with error checking to enable full-screen data entry instead of the horizontal format indigenous to *1-2-3*. And, of course, you can use more-sophisticated macros to create repetitive reports and help with report design. In general, the database portion of *1-2-3* will be easier to use and will produce more consistent results if you include macros in the design.

In addition, an increasing number of third-party support packages are available to help with *1-2-3* database manipulation. They can help you set up macros, that might take hours to create on your own, in just a few minutes. With their assistance, you will begin to see the potential power of *1-2-3* as a database. Reviews of two such products follow.

```
\Q          /dqeq    <----------Get_Data
             {?}~
             {Get_data}~
```

Figure 5: *Database query macro.*

Microsoft is pleased to announce that Microsoft QuickBASIC 2.0 is second best.

By any measure, Microsoft® QuickBASIC 2.0 was an outstanding success.

We'd taken all the things people loved in the BASICA interpreter, and added a ton of advanced features to make a compiler that was faster and more advanced than any BASIC ever.

A compiler that overwhelmed even the toughest judges:

"A snazzy new programming tool that bridges the gap between earlier BASICs and the high-performance languages like C." Peter H. Lewis, *The New York Times,* July 15, 1986.

"(Microsoft QuickBASIC) ...represents an outstanding contribution to the microcomputer world." Dennis Dykstra, *Byte,* February 1987.*

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We looked for more ways to make BASIC better. Ways to make the programming easier and faster. And then we set to work on what became Microsoft QuickBASIC 3.0.

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Based on the technology of the famous CodeView™ debugger included with our C Compiler, it gives you complete control over your program and data. You can observe the contents of any variable. You have your choice of single-step, animate or trace modes.

You can even set dynamic breakpoints at runtime while still using the source for reference. Which lets you easily trace your program's operation without the bother of PRINT statements and recompiling.

This debugger is completely integrated into the compiler. So you can, for example, start debugging your program while it's running by simply pressing CTRL-Break. Instantly, the debugger is activated and you're in control again.

Faster math. And faster programming.

On PCs equipped with math coprocessors, Microsoft QuickBASIC 3.0 blazes through calculations. Our new in-line 8087 code is as fast as you can get. And that's just the start of the speed advantages.

"Microsoft QuickBASIC is phenomenally fast in compilation... (it) outstrips all other compilers." Marty Franz, *PC Tech Journal,* December 1986.

Fast compiling is nice, but it's not the most important consideration. Program development time is.

Microsoft QuickBASIC makes your programming substantially faster by integrating a sophisticated editor into the compiler itself.

Any errors found during compilation trigger the editor to take over, putting your cursor right on the trouble spot.

And if you have more than one error, the editor will keep track of them all, letting you fix your bugs one after another. No more hassles with the endless recompiling of other compilers.

Divide and conquer.

Microsoft QuickBASIC gives you the power of advanced languages without the headaches. A case in point: separate compilation.

Long used in languages like C, separate compilation simply means that you can compile your programs the same way you write them, a piece at a time. Once compiled, your individual modules can be combined into libraries and added to future programs without the bother of recompiling.

But that's just one way Microsoft QuickBASIC supports structured programming.

In addition to the previous Microsoft QuickBASIC extensions like block IF/THEN/ELSE statements, Version 3.0 adds a new set of control structures. Features like the new SELECT CASE, DO WHILE, and DO UNTIL make even the most complex programs amenable to reason.

Still the same. Only better.

After all this work on improvements, we didn't forget what made Microsoft QuickBASIC the success it is. This compiler is still the leader in BASICA compatibility. From graphics to sound, this BASIC commands the PC like no other.

For more Microsoft QuickBASIC advantages, just turn the page.

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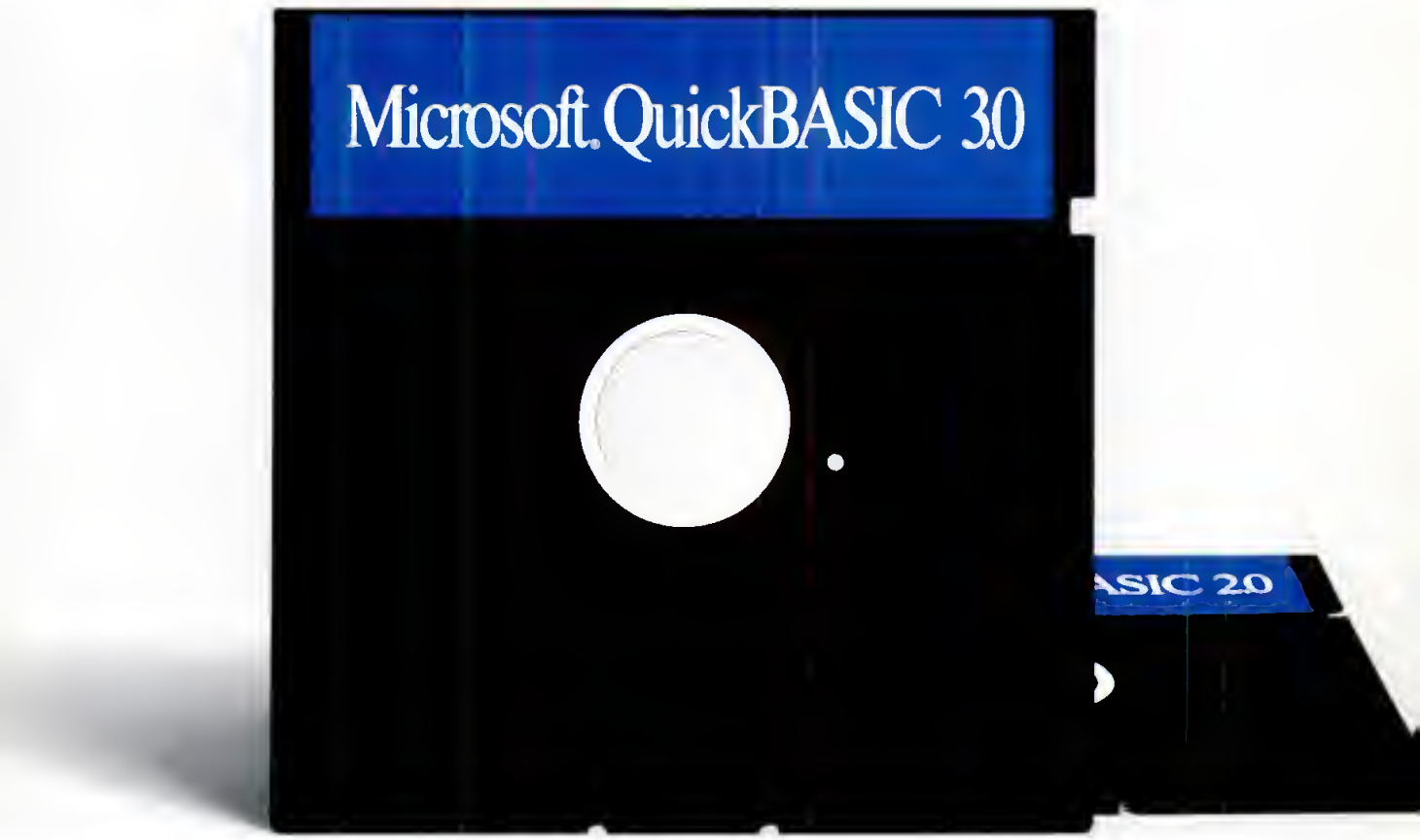


Integrated Program Debugging.

Microsoft QuickBASIC 3.0 includes the most advanced BASIC debugger available. This built-in debugger lets you track both program flow and the contents of variables with ease.

- Three debugging modes: single-step, trace, and animate.
- Set, clear, and examine breakpoints. NEW!
- Adjustable windows let you view source code, variable contents, and program output—all at the same time. NEW!
- Display and search through source code while debugging. NEW!

Advanced Integrated Editor.

The Microsoft QuickBASIC Editor is integrated with the compiler to make all your programming as fast and efficient as possible.

- Built-in editor places cursor on problem in source when error occurs in compilation.
- In contrast to other compilers that give up after finding a single error, Microsoft QuickBASIC's editor keeps track of all errors found during compilation. No more hassles with recompiling over and over.
- Editor supports both Insert and Overtype modes. NEW!
- Fully compatible with SuperKey,® ProKey,™ and SideKick.® NEW!

8087 Math Coprocessor Support.

The standard Microsoft QuickBASIC math package has been enhanced to take advantage of numeric coprocessors in machines that have them. Now you have several ways to optimize your program's performance.

- Microsoft QuickBASIC 3.0 generates fast in-line code for machines equipped with 8087 or 80287 coprocessors. Now your programs can be as fast as the hardware allows. NEW!
- Microsoft QuickBASIC includes full 80-bit IEEE Math support for programs that demand the most precise calculations possible. NEW!
- Choose from the Microsoft Binary Math routines for faster math or the new 8087 software emulation routines for more accuracy when you don't have a coprocessor.

Structured Programming Support.

In addition to the standard BASICA commands, Microsoft QuickBASIC Version 3.0 has a variety of advanced statements and features similar to those found in C and Pascal. By making structured programming easy, Microsoft QuickBASIC makes programs both easier to write and easier to maintain. Older BASIC features like line numbers and GOTO statements are strictly optional.

- New statements include SELECT CASE, DO WHILE and DO UNTIL, LOOP WHILE and LOOP UNTIL, and EXIT. NEW!
- Block IF/THEN/ELSE/END IF statements virtually eliminate any need for GOTOs.
- Subprograms may be called by name and passed parameters.
- Microsoft QuickBASIC now supports user-defined CONSTANTS. NEW!
- Both true local and global variables are supported.
- Microsoft QuickBASIC supports alphanumeric labels as well as line numbers.

Modular Programming Support.

Microsoft QuickBASIC's separate compilation lets you create stand-alone programs a piece at a time. You just compile your routines and add them to a library. Future programs can use those routines by simply linking in your libraries.

- Create stand-alone programs, with or without a separate run-time package.
- Link support routines once at beginning of a programming session, then forget about linking.
- Includes library for access to DOS and BIOS interrupts.
- Microsoft QuickBASIC makes it easy to use professional support libraries such as Softcraft's Btrieve package.

A compiler with both speed and power.

Microsoft QuickBASIC gives you the most advanced compiler features and debugging possible, without any speed handicaps. Microsoft QuickBASIC 3.0 compiles code up to an astonishing 12,000 lines per minute on an IBM® PC/AT.

Microsoft QuickBASIC also supports extra-large programs. Your programs can use all available memory for any mix of code and data. Individual arrays may use up to 64K bytes each (to the PC's limit of 640K).

BASICA Compatibility.

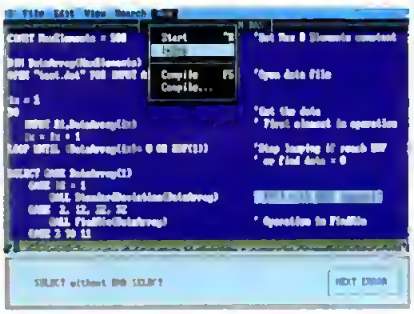
It's not hard to see why Microsoft's QuickBASIC is more compatible with IBM's BASICA than any other compiler. After all, we wrote it for IBM. And we've kept the same features in Version 3.0.

- Graphics statements include WINDOW, VIEW, DRAW, GET, PUT, LINE, CIRCLE, LOCATE, and SCREEN.
- Sound statements include SOUND and PLAY.
- Support for EGA extended graphics modes including the new 43 line mode.
- Supports standard BASICA structures such as GOSUB/RETURN, WHILE/WEND, and event handling.

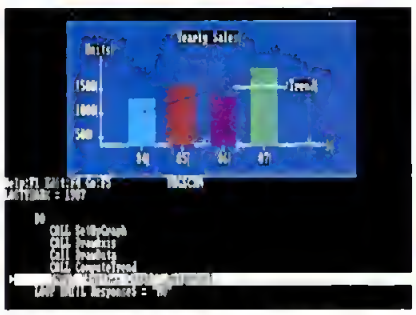
Dramatic execution speed enhancements.

Benchmark	Microsoft QuickBASIC 2.0	Microsoft QuickBASIC 3.0
Graphics (500 Circles)	21.42	9.83
Floating Point Math	16.92	6.48
Quick Sort	5.27	3.02

All test results in seconds. Tests were performed on an IBM PC/AT equipped with an 80287 coprocessor and an 8 MHz clock.



Programming is easier with the built-in editor that searches for all errors, letting you correct them and recompile without leaving the programming environment.



Pinpoint errors by tracing through your source code with the integrated debugger. You can set breakpoints and observe the contents of variables.

Microsoft® QuickBASIC

For more information or the name of your nearest Microsoft dealer, call (800) 426-9400. In Washington State and Alaska, call (206) 882-8080. In Canada, call (416) 673-7638.

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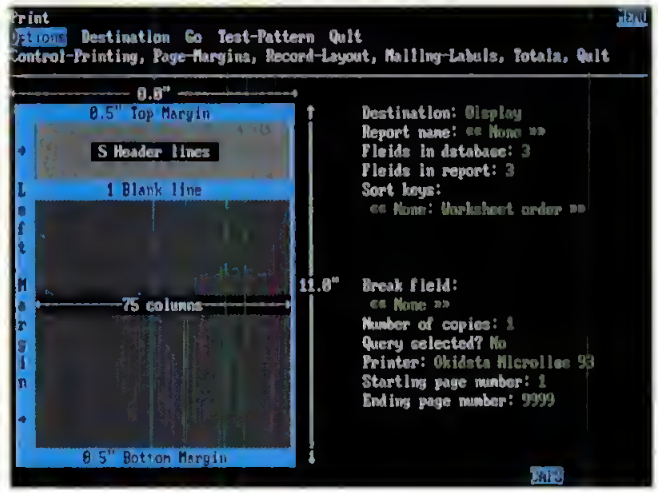
Microsoft®

1-2-3 Report Writer

One popular worksheet support program is Lotus Development Corp.'s *1-2-3 Report Writer*, a package that uses existing worksheet databases to produce custom output. This program adds significant features to *1-2-3*–based database-management applications, including spreadsheet-style menus, four-level sort, easy printer control, painless query construction, and automatic mailing label generation. You can display a report on the screen, send it to a text file, or print it on a printer. A broad variety of printers is supported through a *1-2-3*–type printer driver, which is initialized with an install utility.

There are some constraints that are best handled during worksheet database design. These include a maximum field width of 50 characters (20 digits for numeric fields) and a maximum of 100 fields. Only single-line field labels are supported, and reports that require more than one printed line per record are awkward, at best. Moreover, you can't view a worksheet from within *Report Writer*. If you need some information from the worksheet to create the desired report, you'll have to quit *Report Writer* and load *1-2-3*. Also, the program will work only with database-format worksheets. In the main,

1-2-3 Report Writer *lets you add headers and footers to a report easily. You can also specify a wide range of printer attributes for the header, footer, field name, or field data information.*



1-2-3 Report Writer's *initial /Print command screen presents you with a variety of options for your report preparation and presentation, including page layout, margins, and intended destination.*

This sample report generated with 1-2-3 Report Writer *is based on a sales performance worksheet. You can display a completed report on the screen, save it as a text file, or send it to the printer.*

PC MAGAZINE FACT FILE

1-2-3 Report Writer
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-5500
List Price: $150
Requires: 256K RAM, DOS 2.0 or later, worksheets compatible with Lotus's *1-2-3*, Releases 1A, 2.0, or later, or *Symphony* 1.0 or later.
In Short: A menu-driven report generator for Lotus-compatible worksheets. Has some minor inconveniences, but it gives the worksheet environment the kind of database support you probably thought you were buying with the spreadsheet software. For database-only applications, dedicated DBMS packages are available with more features at a lower cost. Copy protected.

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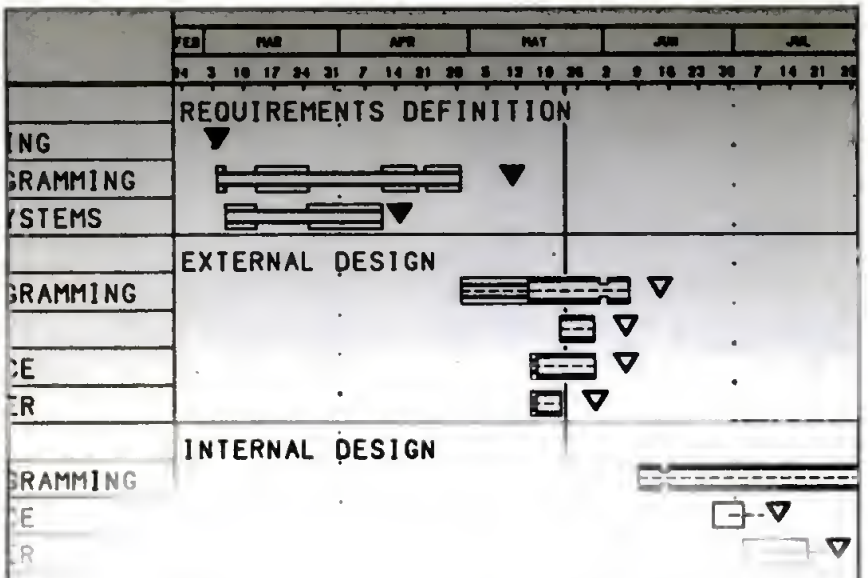

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■ 1-2-3 ADD-INS

however, *1-2-3 Report Writer* solves the problems associated with extracting worksheet database information.

As a Lotus product, *Report Writer* uses the familiar *1-2-3*–style menus and command sequences. There are some enhancements, such as pop-up vertical menus, that make it even easier to use in some ways than *1-2-3*. Compared with raw *1-2-3*, worksheet database reports are a breeze with *Report Writer*. After you specify the worksheet or name the worksheet range you want to use, the available database fields are displayed in the same order and at the same width as in the worksheet. You can use a full-screen editor to change field length (up to 50 characters maximum), delete fields from the display, and rearrange the field order. None of these changes affects worksheet data. You can set up break fields to group report data logically, and you can generate summaries and numeric sums virtually anywhere in the report. The query procedure is straightforward and supports multifield compares in addition to Boolean logic structures.

PRINTER CONTROL Printer control, a problem for many users of *1-2-3*, is easy with *1-2-3 Report Writer*. Everything is selected from a menu or features screen, including compressed print. You can select multiple report copies, and you can tell the report generator which pages to print. You can also use database fields that don't appear in the report as search criteria or break fields.

The software is packaged and documented in the *1-2-3*, Release 2, style. Operation is mainly intuitive. Most users should be able to produce meaningful reports without reading the manual beyond the installation instructions. With *1-2-3 Report Writer* your *1-2-3* worksheet databases can become truly useful and flexible as well.

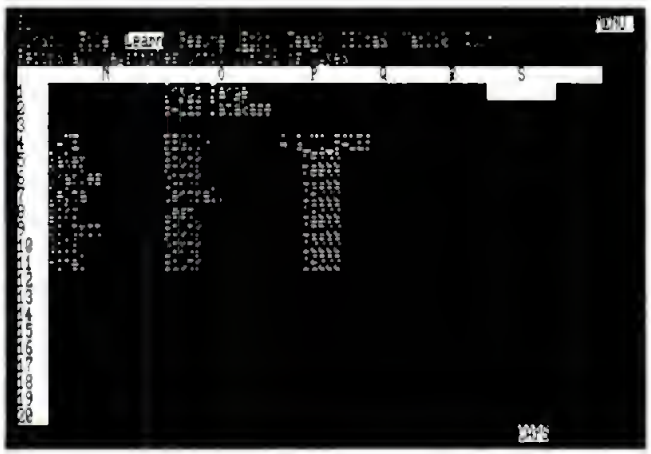
Don't buy the *1-2-3* and *Report Writer* combination for their database features, however. At a total suggested retail price of nearly $650, you'd be paying an extremely high price for what amount to only moderate database features. If you already have *1-2-3* and you'd like to use it for fairly sophisticated database applications, however, *Report Writer* is a good addition to your software arsenal.

Quickcode for 1-2-3

It has been estimated that only about 5 percent of *1-2-3* users are proficient enough with the software to use macro programming regularly. If you are conversant with any computer language, then *1-2-3* programming isn't too difficult, but for beginners it can be a lot harder to learn than BASIC or even *dBASE III*–type code. Fox & Geller's *Quickcode for 1-2-3* is an excellent choice for anyone who wants to get more out of the *1-2-3* environment. With this RAM-resident package, instead of struggling to write worksheet macros to conduct repetitive tasks, you simply step through the commands once, and *Quickcode* writes the macro for you.

The *Quickcode* buffer can record up to 1,000 *1-2-3* keystrokes. That doesn't translate to 1,000 macro commands because some commands require more than one keystroke. The {up} command, for example, uses four keystrokes, and the {left} command takes six. This is actually an ample amount of storage, however, because you can write a set of accumulated keystrokes into the worksheet at any time, then start over again with another keystroke sequence. The resulting worksheet macros can be given English names for easy execution.

Using the *Quickcode* Learn mode, you can play back the stored keystrokes without writing them into the worksheet. This



This database input screen is generated automatically by Quickcode *after you complete the database definition operation. All the macros required to do this work can be created in 10 minutes.*

This Quickcode *Edit window shows sample macro code to set the column width at ten characters for columns A to E.* 1-2-3 *menu commands are entered the same way as if you were writing the macro manually.*

Note the conversion of dBASE*-type code to* 1-2-3 *code in this macro program created by* Quickcode. *The program asks for the name of the created macro during the write-to-worksheet operation.*

PC MAGAZINE FACT FILE

Quickcode for 1-2-3
Fox & Geller Inc.
604 Market St.
Elmwood Park, NJ
07407
(201) 794-8883
List Price: $149
Requires: 384K RAM, DOS 2.0 or later, Lotus's *1-2-3*, Release 2, or later. (Uses approximately 126K of RAM in addition to memory used by *1-2-3*.)
In Short: A RAM-resident utility that installs with *1-2-3*, Release 2, to enhance *1-2-3*'s macro programming capability. A must add-on for anyone seriously using *1-2-3* worksheets, whether a novice or experienced programmer. Not copy protected.

CIRCLE 888 ON READER SERVICE CARD

feature is handy for creating temporary macros during worksheet design, for example, to set a series of column widths or install labels. You can either use the *Quickcode* menu to Echo learned keystrokes, or use the Ctrl-E command.

Another useful feature permits you to store worksheet keystrokes on disk or diskette in a macro library that is separate from the current worksheet.

If *Quickcode* stopped there you could probably justify the cost. But this handy package also includes a credible text editor that you can use to write conventional *1-2-3* macros or programs in *Quickcode*'s PL/123 programming language. This language supports such *dBASE*-type features as DO WHILE loops, memory variables, and IF-THEN-ELSE constructs. You write *1-2-3* programs in a convenient language, then have *Quickcode* convert this code into *1-2-3* macros. One convenience this feature offers: You don't have to include curly brackets ({ }) in *1-2-3* commands, but during the macro creation process, *Quickcode* adds them as necessary.

You can also combine PL/123 language and conventional *1-2-3* macro commands within the same *Quickcode* program. But wait, there's more! *Quickcode* facilitates your *1-2-3* database and data entry applications with a forms generator. Using the *Quickcode* edit window you can specify a database structure, including database name and field labels. The forms generator then creates a *1-2-3* database area and input screen. A custom menu area and supporting macro code are generated to permit you to Add records to the database, Browse the database, Save, and Sort. This facility almost makes *1-2-3* a viable data management tool.

It can take 10 minutes or more for *Quickcode* to write the macros required for even a simple database, but these are complex, error-checking macros that could take hours to write from scratch. Because of limitations of the worksheet environment, a database application operates very slowly and lacks the extended features of a *dBASE III* application, but with *Quickcode* even novices can generate *1-2-3* databases and use them. For the serious worksheet user, *Quickcode* is a better choice as an enhanced user interface than Lotus Development Corp.'s *HAL*.

WORD PROCESSING WITH 1-2-3

In their early days, "integrated" spreadsheet packages were touted as supporting text-handling or word processing features. As serious, low-cost text-handling software became available, we didn't hear about this aspect of spreadsheets anymore. And with good reason. Although Lotus's *1-2-3* can manipulate text entries to produce worksheet documentation or even short letters, a spreadsheet package does not a word processor make.

1-2-3 does include some convenient text-handling features, however, that can offer useful enhancements to a financial or database worksheet. Obviously, you can enter long labels in any worksheet cell, and as long as the cells to the right of the cell of origin are vacant, the text displays across the screen as in a word processor.

FITTING TEXT TO A CELL If you use the /Worksheet Column Set Width command sequence to enlarge a column, then each cell entry occupies a single cell, and you don't have to be concerned about adjacent cell contents. Cell labels can be up to 240 characters long, and you can move the information, one cell or a group of cells at a time. The *1-2-3* Edit key (F2 on the IBM PC) enables you to edit this line of text using conventional text-editing keys. This feature gives you a relatively simple line-oriented text processor as part of the *1-2-3* application.

You can use the /Range Label Right command to right-justify the text in a *1-2-3* cell or range of cells, but the effect is not the same as that produced by right-justify commands in a word processor. In *1-2-3* any right-justified text is actually displayed and printed flush right with the left margin ragged. A more useful *1-2-3* text-handling feature is the /Range Justify command. This sequence lets you specify a column or range of columns, and *1-2-3* adjusts the text within the range to fit within the width of the cell of origin.

Suppose, for example, you have used the /Worksheet Column Set-Width command to adjust the width of column A1 to 60 characters. Now you enter a few rows of text into this column, but because it is difficult to tell precisely where to stop text entry to stay within the specified column width, some of the information spills over into adjacent cells. With /Range Justify, however, you can force the data to fit inside the 60-character width of column A1.

As with most *1-2-3* applications, macros can make word processing in *1-2-3* a lot easier. Here's a simple text-handling macro that uses the /Range Justify command to turn *1-2-3* into a simple, word-wrapping text editor:

```
A   B          C
1   \Z------>  /wcs65~
2   Text--->   {edit}{?}~
3              /rj~
4              {end}{down}
5              {text}
6
```

This is an example of how a macro program can expand the usefulness of a standard *1-2-3* command sequence. Enter this macro exactly as shown, starting in cell C1. Be careful to enter the "~" (tilde) characters as shown. This is *1-2-3*'s symbol for the Return key, which is an important part of many spreadsheet commands. Use /Range Name Create to name cell C1 "Backslash Z" (\Z) and cell C2 "Text". The \Z and Text labels in cells B1 and C1 are used as part of the macro documentation to show the names associated with each cell.

To use this text-handling macro, place the highlight cursor over the worksheet cell where you want to begin text entry and push Alt-Z. The first line in the macro issues the /Worksheet Column Set-Width command and changes the current column to 65 characters wide, a convenient printed-page width. Next, the {Edit} command puts the software into Edit mode, the equivalent of pressing the F2 key, and then enters a macro data entry mode ({?}).

While you're in Edit mode, the information you type appears in *1-2-3*'s edit window at the top of the screen. You can use standard text-editing keys to modify any text entered while in this mode. When you press Return at the end of the line, the

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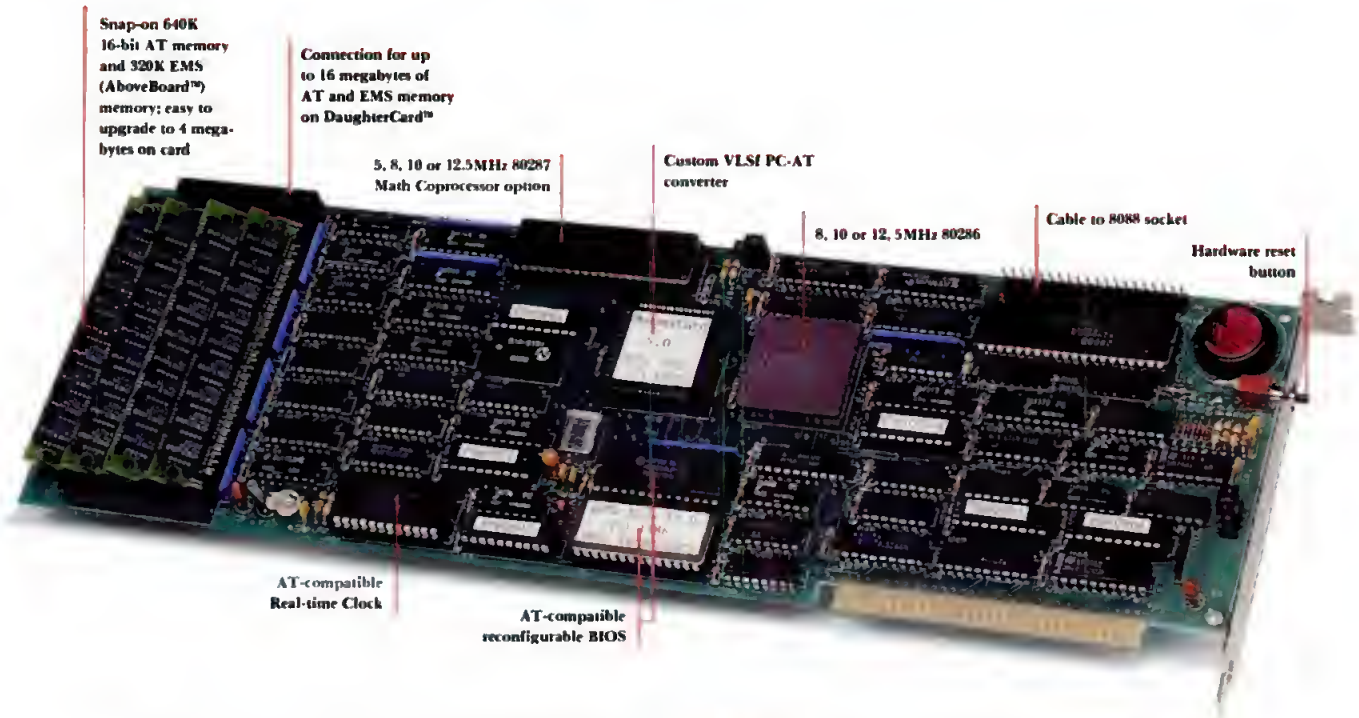

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next macro command sequence, which issues the /Range Justify command, is executed. This breaks the text at the space nearest to the current cell boundary, which is 65 characters in this example.

The {End} {Down} sequence next in the macro moves the highlight cursor down to the first blank line in the worksheet so that you can continue data entry. The {End} {Down} sequence is used instead of a simple {Down} because you can enter up to 240 characters in a single edit window, which would take up nearly four 65-character lines.

The final command in cell C5 starts the macro over again at cell C2, the cell labeled "Text". If you are using Release 1A of *1-2-3*, change this last command to /XGText.

There is one slight problem with this macro. If you enter fewer than 65 characters in any one line, the {End} {Down} sequence will send the cursor to the last cell in the worksheet. If this happens, enter the sequence {Up Arrow} {End} {Up Arrow} {Edit} to return to the last line of text. As long as you enter at least 65 characters on each line, this macro gives *1-2-3* at least some word processing power.

Why would you want text-handling features of this type in a *1-2-3* worksheet? For worksheet documentation, for one thing. Far too many worksheet designers neglect the chore of documenting their work—possibly, in part, because text manipulation in *1-2-3* is a little cumbersome. This text-handling macro helps ease that problem. Of course, you can use word processing software for this task, then import the finished text document into *1-2-3*. Simply save your word processor document as an ASCII text file, then load *1-2-3*. Place the highlight cursor where you want the text to appear, then issue the /FileImport Text command and specify the text filename. Each line of the text file will occupy a single worksheet cell as a long label entry. You can then increase the cell width to an appropriate size and issue the /Range Justify command to improve the appearance of the imported text, if necessary.

MERGING DATABASE TEXT You may also want to merge the contents of a *1-2-3* database with worksheet text. This is a good application for printing multiple memos or form letters driven from a database name and address file. Consider the database sample in Figure 1. With *1-2-3*'s @Index function, you can merge the database information with a memo or letter that is customized for each recipient. The @Index function takes the form

```
@INDEX(range,column,row)
```

and returns the contents of the cell specified by the intersection of column and row within the worksheet range. The range is the entire database area you are working with. In Figure 1 it would be B2..D6. In this function the first column is column zero and the first row is zero. To display the first database name in a worksheet cell, you would enter

```
@INDEX(B2..D6,B2,1)
```

You can display just the last name by combining the @Mid string function with the @Index function. *1-2-3*'s @Mid function is analogous to BASIC's @MID$ function. Also, use *1-2-3*'s @Find function to specify the number of characters to display by searching for the comma in the reverse name. The last name in the first database record in Figure 1 can be displayed with the following cell entry:

```
@MID(@INDEX(B2..D6,B2,0),0,@FIND(",",B2,0))
```

You can display the name in first-name/last-name sequence with the following string concatenating cell entry:

```
@MID(@INDEX(B2..D6,B2,0),@FIND(",",B2,0)+2,99)&" "&
   @MID(@INDEX(B2..D6,B2,0),0,@FIND(",",B2,0))
```

(The long entry in this example is split for clarity.) In a worksheet environment you would enter the entire function string in a single cell. You can merge other entries in this database with text by modifying the @Index function to reflect the proper row and column within the database range.

Suppose you have a name and address database that occupies the range B2..I40, which is named "NAD" and created by the sequence /Range Name Create NAD. Figure 6 shows the record structure for this sample database. Note that when you use the @Index function you don't have to expand the cell widths in the database area to display the full cell contents. During a print operation, however, you must specify a range that includes the full data you want printed. In other words, if your letter originates in column AA, but portions of it—including the name and address—spill over into AD, you must include column AD in your print range or the printed copy will be truncated.

DISPLAYING RECORDS In order to display the complete name and address for the first entry in the database, simply use the sequence of *1-2-3* functions that is shown in Figure 7.

In Figure 7 we have used the single-cell named range, Row—here cell AG1—to store the row or database record to display. By changing the value of the Row worksheet cell, you can sequentially display all of the names and addresses stored in the database.

Place this sequence of functions at the proper place for an address in a letter you generate with word processor text imported into *1-2-3* or by using *1-2-3*'s text-handling features. You then can either print the letter manually, changing the value of the Row pointer each time, or write a macro that increments the Row counter and prints the worksheet range that contains the form letter. Note that when you combine a normal text string with a string formula as shown in cell AA9, in Figure 7, you must enclose the string in quotes and precede it with a plus sign.

Use the /Range Format command sequence to display the date in cell AA7 in one of *1-2-3*'s standard date formats.

Recently, a number of third-party products designed to help you with text-handling functions in *1-2-3* have appeared on the market. Reviews of four such products follow.

```
|||||||
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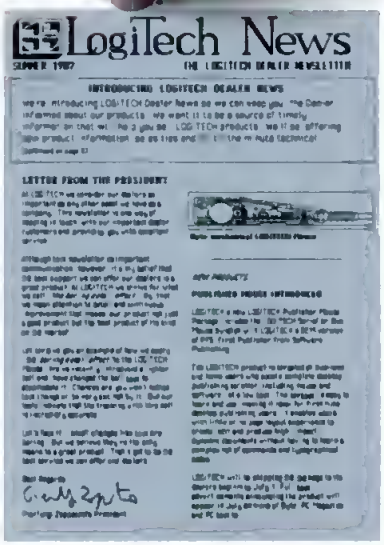
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```
|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
    AA          AB          AC          AD          AE          AF          AG
1   @INDEX(NAD,0,Row)&" "&@INDEX(NAD,1,Row)                                    1
2   @INDEX(NAD,2,Row)
3   @INDEX(NAD,3,Row)
4   @INDEX(NAD,4,Row)
5   @INDEX(NAD,5,Row)&", "&@INDEX(NAD,7,Row)&" "&@INDEX(NAD,7,Row)
6
7   @NOW
8
9   +"Dear "&@INDEX(NAD,1,Row)&","
10
11  ||TEXT OF LETTER STARTS HERE||
12
13
|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
```

Figure 7: *Name and address display.*

4-Word

Turner Hall's *4-Word* is one of the first fully functional word processor add-ins for Release 2 of *1-2-3*. Using the Lotus Add-In Manager to attach directly to *1-2-3*, it becomes an integral part of the Lotus software and makes word processing in *1-2-3* much easier to accomplish.

Once it is installed, *4-Word* is accessed with a user-specified function key sequence that permits smooth switching between spreadsheet manipulation and word processing functions at will. You can even install *4-Word* so that when you start *1-2-3*, the word processor is the default operating environment.

In effect, *4-Word* uses the same cell matrix as *1-2-3*. The difference is in the way the data is displayed and accessed. Text created in the *4-Word* environment is actually entered into the current *1-2-3* worksheet column as a left-aligned label. Any worksheet data that was entered in the same column appears in the text environment of *4-Word*, but you can't edit or manipulate anything except label entries. Numeric data is locked, and you can't touch it until you use your switch sequence to return to the worksheet.

4-Word lets you use *1-2-3*'s environment to store and manipulate text entries; it also adds such desirable features as setting bold and underlined text. Because *4-Word* and *1-2-3* are tightly coupled, you can insert text within a worksheet to create letters, reports, or worksheet documentation. You can establish a restrict range within *4-Word* to limit the worksheet affected by the word processor. Otherwise, *4-Word* has full run of the worksheet and will bump down information from the column of origin into lower rows, which is not always a good feature since it could misalign the horizontal worksheet cells.

MAIL-MERGE One of the most useful features of *4-Word* is the automatic mail-merge function. The software can merge a *1-2-3* name and address database with a text document and print personalized letters. A clue to the close relationship between *1-2-3* and *4-Word*: the text print operation uses *1-2-3*'s /Print Printer option. *4-Word* itself has no built-in print utility. You can import data from other files by using *1-2-3*'s file import utility. You can attach specified worksheet ranges outside the word processor's cell of origin to the text document, but when you do, *4-Word* marks the worksheet range in such a way that some spreadsheet /Data Query operations may not work properly. If you forget to set the restrict range properly, a merge operation can move worksheet cells around, causing other database operations to malfunction.

4-Word offers most of the features you would expect from a modern word processing package, including such text enhancements as bold, underline, superscript, subscript, italics, and more. You can center and right-justify text, as well as combine files from other *1-2-3* files or other word processors. *4-Word* uses Lotus-style menus for nearly all operations, and it is so closely related to *1-2-3* that most operations are intuitive for experienced users of *1-2-3*. Any text created in the text environment also appears in the linked worksheet when you return to the spreadsheet environment.

The bottom line on *4-Word* is that while integrating *1-2-3* with word processing sounds like a fine idea, this implementation isn't a particularly slick one. For one thing, you have to switch back and forth between the text and spreadsheet environments if you want to make changes to worksheet information that is integrated with the text. By comparison, Lifetree's *Words & Figures* handles the word processor/worksheet link much more smoothly by letting you to make changes to worksheet data in either the text or spreadsheet modes. With *Words & Figures*, changes made to cells in one environment are reflected in the other environment.

Moreover, *4-Word* implements its text enhancement features in an old-fashioned manner. Underlined text, for example, is marked at the beginning with a solid triangle and the letter *u* and at the end with another solid triangle. Bold text and other enhancements are implemented in the same way. These formatting characters also appear in the worksheet when you switch out of the text environment. Most modern word processing products hide such print attributes so they don't interfere with the screen display.

To conduct such operations as right-justifying or centering text, you must insert a "format line" on the line above the beginning of the desired attribute. This format line rides with the rest of the text and is

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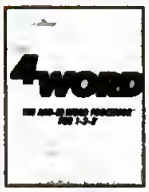

4-Word
Turner Hall Publishing
10201 Torre Ave.
Cupertino, CA 95014
(800) 556-t234
List Price: $99.95
Requires: 320K RAM, DOS 2.0 or later, Lotus's *1-2-3*, Release 2, or later. (*4-Word* uses 60K RAM in addition to DOS and *1-2-3* requirements.)
In Short: RAM-resident word processing software that works with Lotus's *1-2-3*, Release 2, or later. Text is stored in a single column of a *1-2-3* worksheet as a left-aligned label, but *4-Word* provides a user interface that emulates a word processing environment. Can share numeric or other data with a *1-2-3* worksheet. Not copy protected.

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Because all 4-Word text appears in a single column, you're likely to find it particularly suited to macro writing. Here you see the 1-2-3–like main menu available in 4-Word by pressing the F10 key.

Note the characters that surround the linked data. You can edit linked cells in text mode, but changes do not appear on the worksheet. Changes made to link cells in the spreadsheet do appear in the document.

Here the database section of a worksheet is linked to a text document. Although the formatting marks are displayed continuously, they do not print when you output the text document.

always displayed with the document. It also appears in the worksheet, and, as an inserted line, bumps other data in the column of origin down one row. Again, nearly any microcomputer word processor written in mortal memory makes this kind of data transparent to the user. The fact that it is not hidden even in the spreadsheet environment makes it particularly intrusive.

■ *4-Word*'s close ties to *1-2-3* result in a mixed bag of strengths and limitations that should be considered before a commitment is made.

This integrated word processing feature may be useful if you regularly combine spreadsheet information in statements, proposals, and reports. However, you can do the same thing with *1-2-3* by exporting the information to a .PRN file and importing it into a word processor. Using a .PRN file gives you full control over the resulting worksheet data, allowing you to edit and format even numeric entries. *4-Word* won't let you do this, but it offers the benefit of an interactive link with the worksheet.

The down side is that *4-Word* is so closely tied to the Lotus spreadsheet environment that it suffers from many of the same limitations that *1-2-3* users have complained about from the beginning: nested menus that are sometimes cryptic and difficult to follow, frustrating restrictions in the way in which data can be manipulated, and all the inherent limitations of a cell-oriented structure. *4-Word* may be a good choice for some word processing and spreadsheet functions, but no one should go out and purchase it expecting to be handed an easy-to-use, office-type word processor. Its close ties to *1-2-3* result in a mixed bag of strengths and limitations that should be considered carefully before a commitment is made.

InWord

Funk Software's *InWord* is a real word processor that integrates well with Lotus's *1-2-3* spreadsheet environment without sacrificing flexibility in either application.

InWord is the most versatile and functional of the *1-2-3* word processing packages reviewed here. It includes most of the features you expect in a word processor, and all of the functions are available from a *1-2-3*–style menu. You can search for text, replace text, paint blocks with an expanding cursor, and then move, copy, or delete the block. *InWord* also supports bold text and underlining.

Operation is intuitive and easy to learn. If you have a reasonable amount of experience with *1-2-3* and with any word processor, you should be able to operate *InWord* right out of the box.

Like Turner Hall's *4-Word*, *InWord* uses the Lotus Add-In Manager to attach directly to *1-2-3*. The Add-In Manager installs in the *1-2-3* driver to support function key access of attached applications. Unlike *4-Word*, the documents for *InWord* are separate from the current worksheet. The *InWord*/*1-2-3* pairing is like two full-screen windows: one that holds a *1-2-3* worksheet and another that holds a text document. You toggle from the worksheet to the text document with an Alt-function key combination, then return to the work-

Funk Software's InWord *has virtually all the word processing features you are accustomed to having when you write documents. Here, the menu-driven copy block mode is displayed on the screen.*

Like some popular word processing packages, InWord *uses pop-up menus to guide you through its features. This menu lets you select page-formatting features, such as page size and margins.*

InWord *is put to the test with this sample text file complete with linked cell and table. With* InWord, *you can copy a single cell or a block of cells from the current worksheet into a document.*

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InWord
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(617) 497-6339
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Requires: 70K RAM plus memory required for DOS and *1-2-3*; DOS 2.0 or later; works only with *1-2-3*, Version 2.*x*.
In Short: RAM-resident word processor linked with Lotus's *1-2-3*, Release 2, or later. Full-featured word processor that can incorporate dynamic *1-2-3* worksheet ranges and exchange information with a worksheet. Uses *1-2-3*–style menus and intuitive user interface. It is the most versatile of the word processor add-ins. Not copy protected.

CIRCLE 694 ON READER SERVICE CARD

sheet by pressing Esc while in *InWord*.

With *InWord* you can copy single cells or a block of cells from the current worksheet. An option Funk calls Zoom also lets you link a worksheet cell or table to the word processing document. In the copy mode, data is simply copied from the worksheet to the text document. With Zoom, a specified cell or block of cells (table) appears in the text document and will change as worksheet information changes. This link is more flexible than *4-Word*'s because you can attach a single cell and use standard word processing techniques all around this cell. Unlike *4-Word*, which is line-oriented, *InWord* establishes a worksheet environment in the text document only for the cell or cells that are attached from the worksheet. This permits a much more flexible worksheet/text link.

The *InWord*/*1-2-3* combination provides virtually the same functionality offered by Lifetree's *Words & Figures*, but you also enjoy the full functionality of *1-2-3*'s Release 2. *InWord* also lets you ship word processing data over to the worksheet, a feature not available in *Words & Figures*. This is a straight copy function, however. Once the data has been copied to the worksheet, changes to the same text in the word processor are not automatically reflected in the worksheet.

COMPATIBILITY *InWord* supports mail-merge functions. By establishing a database area for names and addresses, you can write a letter in *InWord* and print a series of personalized letters automatically. *InWord* also appears to be compatible with Lotus's *Metro*, the desktop organizer package that includes a notepad and full-screen editor. Files prepared in *Metro*'s editor or notepad can be loaded directly into *InWord* using *InWord*'s ASCII file-retrieve menu choice. *InWord* saves and retrieves files in two formats: the word processor has its own format, or you can use a generic ASCII format. This enables you to load and edit .PRN or other ASCII files, including those from *Metro*.

Unfortunately, after you load an ASCII file into *InWord*, you can't save it in *InWord* format. Apparently the package keeps the formats separate: it refuses to save a file loaded in an ASCII format as an *InWord* file. Indeed, if you try, any changes made to the document after it was loaded will be lost.

InWord is reasonably fast, except when saving or retrieving ASCII files, which is extremely slow. When handling its own text format, however, the I/O process runs at an acceptable speed. You can toggle between the top and bottom of even long documents almost instantaneously, and the PgUp and PgDn keys move information rapidly a screen at a time.

■ If *1-2-3* is your major operating environment, *InWord* may well be the only word processor you'll ever need.

The PC's special function keys add functionality beyond the standard *InWord* menu items, including on-line help and foreign or graphics characters. Special characters are selected from a pop-up window display that lets you move the cursor up and down a list to choose which character or symbol to insert into the document.

Note that when you copy or attach worksheet information to an *InWord* document, the process conforms to Release 2's print range procedure. You select copy or zoom from the *InWord* menu, and the current worksheet is displayed. Then you can point to the cell(s) to link to the text document. If the specified cell includes information that overflows into adjacent cells, you must include the overflow information in the copy or zoom range. Otherwise the data will be truncated in the *InWord* document. The same thing happens in Lotus's *1-2-3*, Release 2, when you conduct a print operation, so *InWord* conforms to Lotus conventions.

GOOD BUT NOT PERFECT As good as it is, *InWord* could use some improvements. For one thing, when you exit *1-2-3*, even with the /System command, *InWord* is detached and the current document is lost. When you save the *InWord* document, its link to the current worksheet is retained, so you can reload the document and the worksheet information remains intact. Note, however, that the link is not to a specific worksheet or worksheet data. Rather, *InWord* holds a pointer to a specific cell or range of cells within whatever worksheet is loaded into memory. If you load another worksheet, different data will appear in the *InWord* document.

When the worksheet or linked cell is blank, *InWord* displays @ (the commercial at-sign) to show that a worksheet link exists. This imparts a great deal of flexibility and reduces the amount of storage required when saving the text document because the attached worksheet doesn't have to be saved with it. If you save the document as an ASCII file, however, the link to the worksheet is lost.

You have to be careful about using the *1-2-3* /System command because anything in *InWord* that hasn't been saved to disk will be lost. The problem is that *InWord* reloads itself each time *1-2-3* is started, whether as an exit from the resident mode or as a cold load. This is a potential limitation. In addition, the fact that you can't import an ASCII file and convert it to native *InWord* mode is an annoyance because the ASCII mode is slower, and you can't retain links with a worksheet when using ASCII files. Moreover, if you attempt to save an ASCII file as an *InWord* document, an error message will be displayed and the file will be erased from memory.

InWord won't replace *WordPerfect* or other heavy-duty business-oriented word processors, but if *1-2-3* is your major operating environment and your word processing needs are moderate, this $99 package may well be the only word processor you'll ever need.

Note-It

Turner Hall's *Note-It* is a text-handling worksheet add-in that users at all levels will probably find helpful. *Note-It* is patterned after 3M Post-it notes—the sticky little pieces of colored paper we attach to computer screens, desktops, reports, books, and diskettes.

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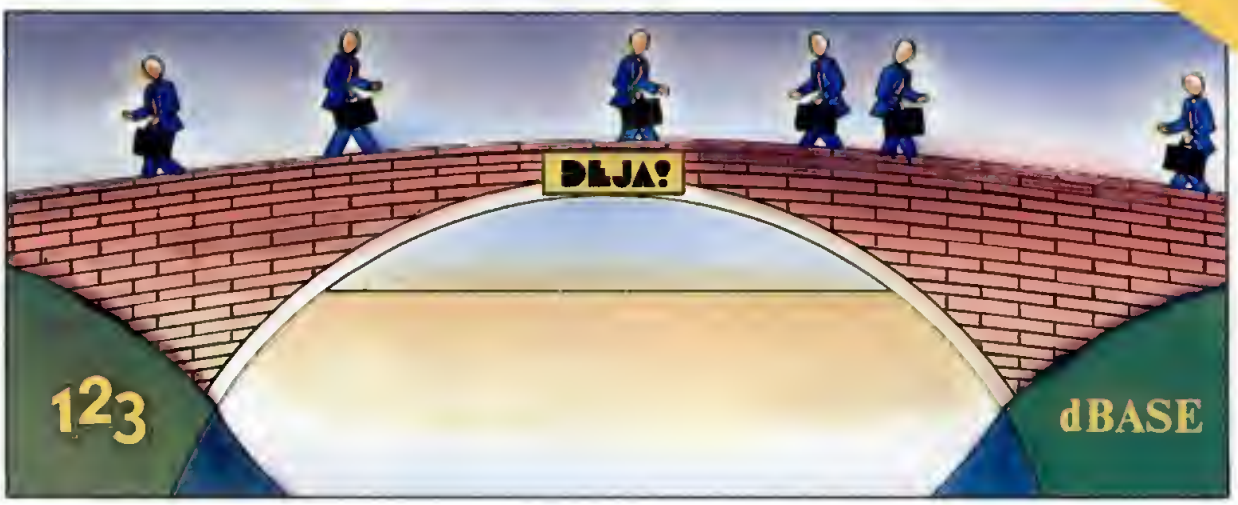

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PC MAGAZINE FACT FILE

Note-It
Turner Hall Publishing
10201 Torre Ave.
Cupertino, CA 95014
(800) 556-1234
List Price: $79.95
Requires: 384K RAM, DOS 2.0 or later, Lotus's *1-2-3*, Releases 1A, 2.0, or later. (Uses approximately 70K RAM in addition to memory required by *1-2-3*.)
In Short: RAM-resident spreadsheet-annotating software. Loads with *1-2-3* to support up to a hundred 500-character notes added to individual worksheet cells or directory entries. Helpful in documenting worksheet formulas, cell relationships, and other worksheet design features. *Note-It* notes cannot be transferred directly into a worksheet. Not copy protected.

CIRCLE 697 ON READER SERVICE CARD

to Lotus's *1-2-3* worksheet directory entry. Up to 100 of these notes can be added to a worksheet. The program functions with either Release 1A or 2.*x*. It affords access to some DOS-level commands, including directory listings, file renaming, and delete.

Note-It works by creating a separate note file for each worksheet or directory entry you want to document. Note files attached to a directory entry require 600 characters of disk space each, regardless of how much information you actually put in them. The worksheet note files can grow to 66K bytes if you fill the worksheet with the maximum number of notes.

To use *Note-It*, you first merge a four-cell worksheet from the *Note-It* diskette into your active worksheet. These cells contain formulas that include pointers to cells that have notes attached. The *Note-It* software modifies these cells as you document the worksheet. However, if you forget to save the worksheet after the notation is added, the attached notes will be lost even though a separate file was used for the notes.

Although you could create similar documentation by using hidden ranges within the worksheet, you could spend hours constructing macros to impart any real functionality to this documentation. Even then

This screen shows Note-It*'s edit window. Visible at the top of the screen is the program's Lotus-style menu. Up to 500 characters of text can be appended to an individual spreadsheet cell.*

Note-It*'s most useful feature is its capability to list all of the worksheet cells that have notes attached to them. This flagging system allows someone who examines the spreadsheet to know exactly where to find the notes.*

Like Funk Software's InWord, Note-It *employs pull-down menu windows to assist you in accessing its features. This window contains the various document printing options for the program.*

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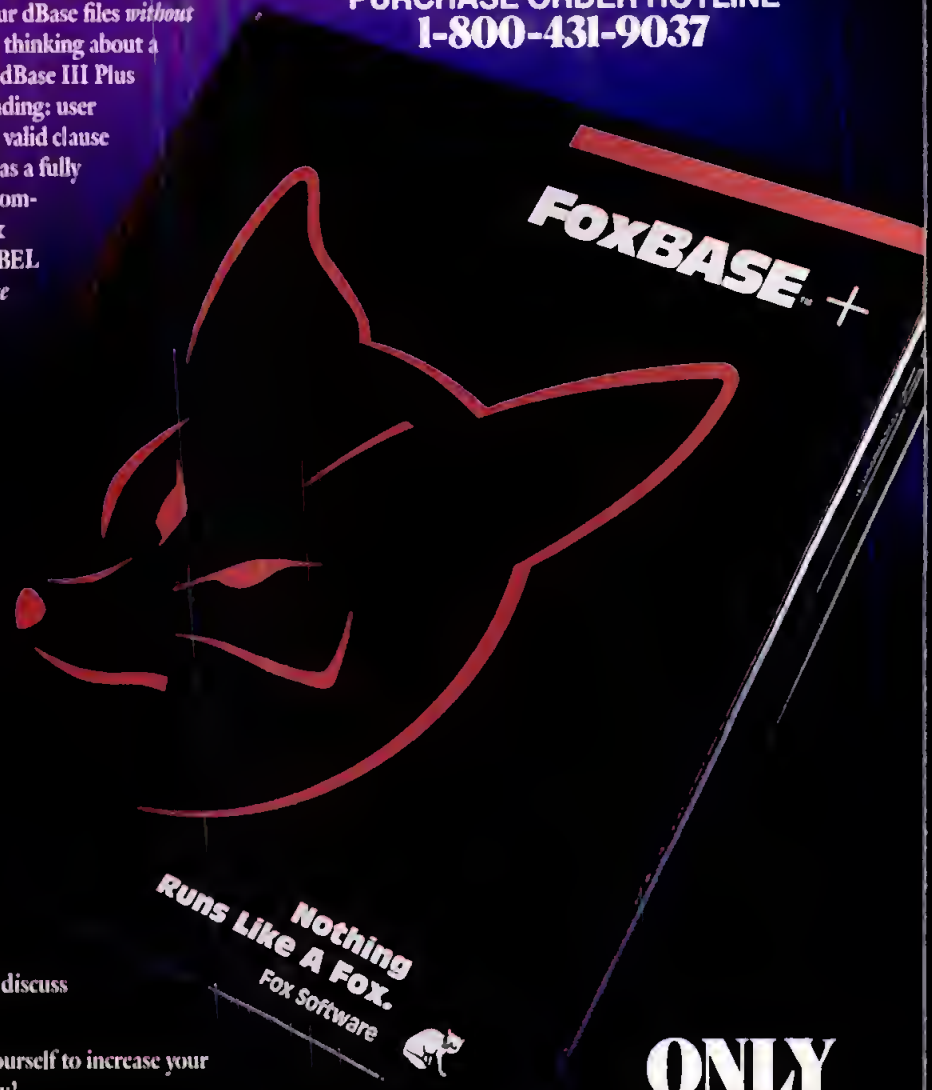

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Inverted Back

1. Follow instructions on the other side

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GbsSlipSheet-001

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1. Open the foldout page
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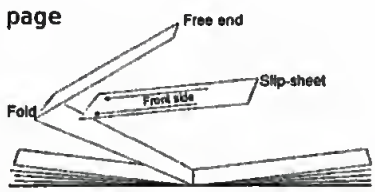
. Slice the folded edge
   Close the page and slip-sheet



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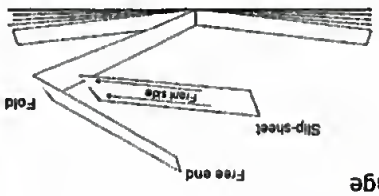

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you wouldn't have the convenience and features of *Note-It*. For example, *Note-It*'s Lotus-style menus let you choose List, Search, Delete, Printer, and File operations. Pull-down menus from these selections afford more choices. You can print worksheet notes one at a time in context, which shows a full-screen area of the worksheet around the note you're printing, or you can print all of the notes with their cell addresses. You can search for notes that contain specified strings of information, and you can list on the screen all cells that contain *Note-It* notes before you print them.

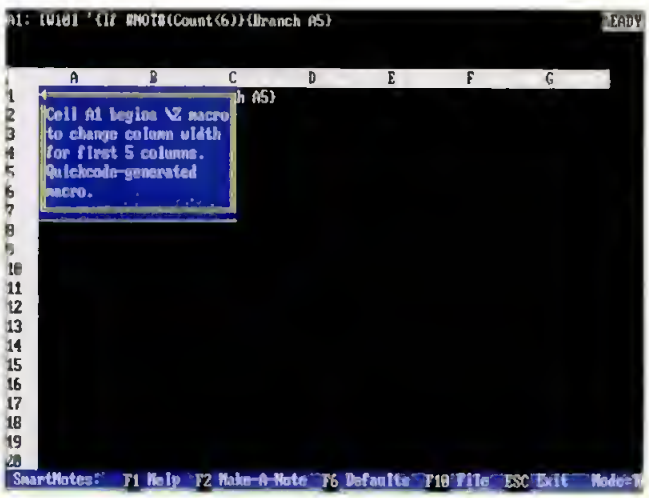
Until you pull up the *Note-It* menu, you can use the worksheet normally and never know there is information attached to any of the worksheet cells. However, if you move cell contents to another worksheet location, the notes for these cells remain at the original location. This also occurs if you sort a range of cells because *Note-It* documents physical worksheet cells and not cell data.

We experienced only a couple of problems with this useful add-in. For one thing, it wouldn't function with *ProKey*, another memory-resident utility, but we had no problems using *Note-It* with *SideKick*. The documentation warns of this possibility and also suggests some ways to handle other potential program conflicts, such as two RAM-resident utilities that use the same command key sequence. A more serious problem occurred when *Note-It* tried to write a file to a full disk. The system locked up, requiring a reboot, and the note file was lost.

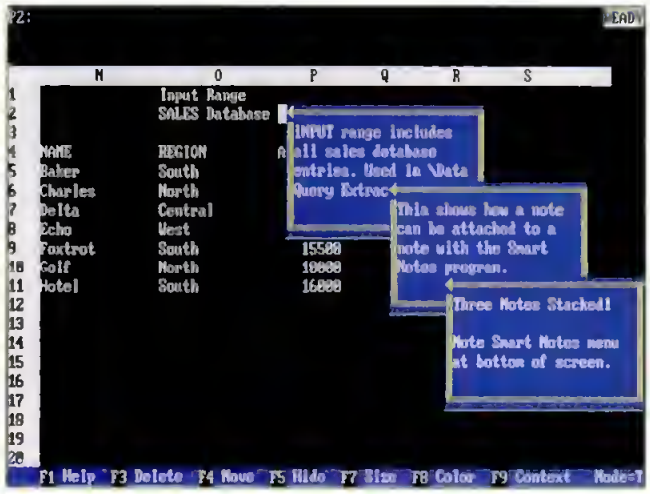
SmartNotes

Personics Corp.'s *SmartNotes* is another RAM-resident utility that uses pop-up windows to attach text notes to on-screen information. Like *Note-It*, *SmartNotes* also can attach notes to DOS directory entries, but you can also use *SmartNotes* with word processors, database programs, and other applications.

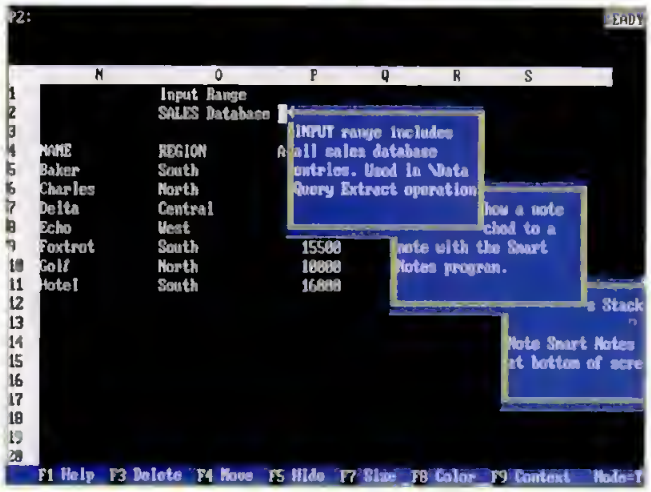
With a few exceptions (games and heavily graphics-oriented programs) *SmartNotes* works with just about any program. You can even attach *SmartNotes* to information displayed from other pop-up programs, including *SideKick*. This fea-



In this sample 1-2-3 database file, cell A1 contains a Quickcode *macro, and a note has been attached to the same cell.* SmartNotes *can attach a note to almost any application program text.*



Like paper Post-it notes, SmartNotes *can be attached to each other electronically. Unfortunately, if you get carried away, you can stack up more notes than can be seen at one time on the screen.*



When you are reading stacked notes and can't see some of the buried text, SmartNotes *highlights the note that contains the cursor and moves it on top of other notes so it is able to be read easily.*

ture lets you expand such data as *SideKick* calendar entries.

When you start *SmartNotes* for the first time during a computer session, you are asked to identify the name of the note file you want to use. After that, the same file will be used until you specify another one. Obviously, you should keep track of which file is in use so that your notes appear in the proper note file for different applications. When you call up *SmartNotes* during another application, a one-line menu appears at the bottom of the screen, and you are placed in full-screen mode. You place the cursor anywhere on the screen to mark the location of the next note. When you press the F2 key, a small note window opens at the cursor location. When you press Esc you are returned to the *SmartNotes* menu and screen movement mode. An edit mode lets you change notes or even move them around the screen to different locations.

There seems to be no limit to the number of notes you can attach to a document or worksheet, and you can even stack up notes, adding notes to notes. In the screen-movement mode, the cursor moves on top of any other windows or text as it passes through each note window on the screen, so you can read it. When you push Esc to exit *SmartNotes*, all of the note windows disappear, and you can use the current application normally. Unfortunately, you can stack up more notes than can be displayed on the screen. Although *SmartNotes* moves the note window into the screen to permit you to enter the note, if the stacked note doesn't fit on the screen when it comes time to display the information, you won't be able to view all of the notes you have created.

■ With a few exceptions (games and heavily graphics-oriented programs) *SmartNotes* works with just about any program.

SmartNotes doesn't have a search-and-list feature like the one in *Note-It*, but you can enter *SmartNotes* to display any notes attached to the displayed text, then press PgDn to bring up the next screen or block of data. If the next screen contains any notes, you stay in *SmartNotes*, and the notes pop up on the screen. If there are no notes on the next screen, you automatically exit *SmartNotes* and return to your current application.

This is a potentially useful program, especially for those who deal with complex applications such as creating spreadsheets and tracking complicated directory structures. Unfortunately, the 90K RAM overhead can be pretty severe, depending on your computer configuration, and there is no apparent way to dump *SmartNotes* to retrieve this memory except to reboot the system. PC

Tom Badgett is a computer industry researcher and free-lance writer based in New Jersey. His most recent book is Insider's Guide to Lotus 1-2-3.

PC MAGAZINE FACT FILE

SmartNotes
Personics Corp.
2352 Main St . Bldg. 2
Concord, MA 01742
(800) 445-3311
(800) 447-1196 (in Mass.)
List Price: $79.95

Requires: 256K RAM, DOS 2.0 or later. With *1-2-3* and other large programs, 512K RAM recommended (*SmartNotes* requires approximately 90K RAM in addition to DOS and any other resident application.)

In Short: A RAM-resident program that attaches text notes to virtually any application program text, worksheet cells, and DOS directory entries. Works with virtually all software, but we found frequent function-key conflicts with full-featured applications such as *WordPerfect*, and the 90K memory overhead can be a limitation for some users. *SmartNotes* notes cannot be transferred directly into a worksheet. Not copy protected.

CIRCLE 696 ON READER SERVICE CARD

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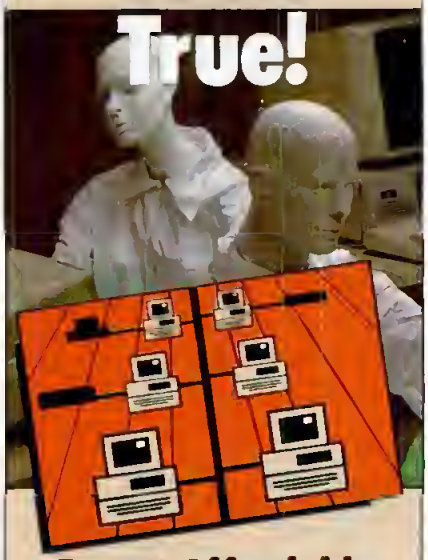

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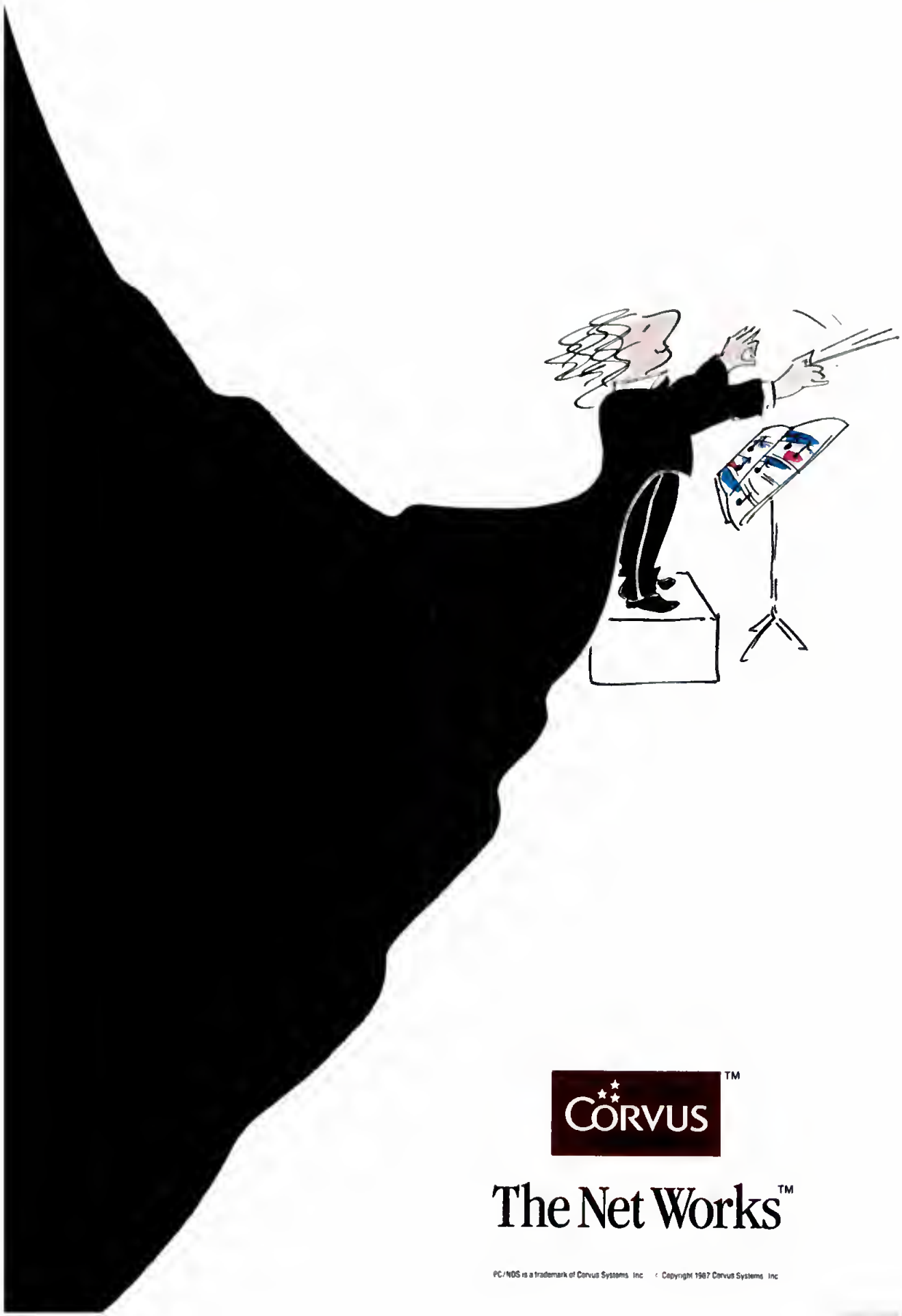

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CIRCLE 281 ON READER SERVICE CARD

TWO-WAY STRETCH

The plain-vanilla PC got one more blow to the body when IBM Corp. recently introduced its new line of personal computers. The Personal System/2 has shaken up the personal computer industry, boasting speedy processors (8 or 10 MHz), faster hard disks, and a whole new video standard. Compared with these sleek, muscular machines, the original PC is more than just the proverbial 97-pound weakling now: running at only 4.77 MHz, it seems terminally anemic.

Fortunately for PC owners, a couple of wonder drugs can help their unsightly, laggard machines stalk the state of the art. EGA graphics boards will

Combination turbo-EGA boards from Sigma Designs and Orchid Technology increase processor speed and bring higher-resolution graphics, providing a quick and easy one-slot solution to upgrading your 8088-based PC.

SPEED BUMPS

The two basic methods of accelerating your PC do provide higher performance, but only through an uneasy cooperation between host computer and turbo board.

All turbo boards fit one of two classes: replacement processors or coprocessors. Coprocessors work in cooperation with the microprocessor already in the host computer. Replacement accelerators take over all the chores of the original microprocessor. Both the TurboCache EGA! and Turbo EGA are replacement-style turbo products.

In years past, the biggest advantage of the coprocessor board was its speed. Essentially a single-board computer that is designed to be installed inside slower PCs, the coprocessor board comes fully equipped with a high-speed microprocessor, its own random access memory system, and its own BIOS (Basic Input/Output System) software. The turbo circuitry takes total control and uses the native microprocessor in the host system merely for basic input and output (I/O) operations.

Much of the speed advantage of the coprocessor board is achieved with its independent memory system. Because the architecture of this memory is not limited by the constraints of the host system, it can use a wider data bus and faster access rates to give faster performance.

However, coprocessors are notoriously complex. After all, you have two independent computer systems that must—sometimes grudgingly—cooperate. They are often difficult to set up and sometimes give quaky and jumpy video displays.

Replacement-style turbo products avoid these problems. Instead of replacing the entire system, they merely upgrade what's already there. However, they remain bound by the performance limitations of the host computer's memory, which can limit the speed boost they provide.

These two turbos use high-speed cache memories to circumnavigate the host memory speed limits. Both systems use a block of static RAM with a 16-bit data bus as a buffer between the turbo microprocessor and host system memory. The memory cache stores data for faster retrieval by the replacement high-speed microprocessor. Special circuits load the buffer while the turbo microprocessor is doing its other thinking. Relying on the caching system is the key to improving speed; applications that are disk-intensive will force you back to the slower I/O constraints of the host PC.

Although the cache allows the turbo microprocessor to bypass the host's slower 8-bit memory, the replacement microprocessor uses all the standard system resources, including the original IBM BIOS, so it acts like a PC in nearly every way. Both the TurboCache EGA! and the Turbo EGA showed a high degree of compatibility—even running IBM's partly ROM-based BASICA without a problem. The only difference you should notice is speed—and lots of it. The Turbo EGA completed the benchmark tests 67 percent faster than would an un-turboed XT. Of course, it's held back from delivering this measure of performance in all applications by the limitations of its caching system. Compared with an AT, data transfers from disk will also be more leisurely because of the 8-bit I/O constraints of the host PC.

—Winn L. Rosch

give any PC a better on-screen look: higher resolution and more colors. And turbo boards can boost system throughput from dilatory to delightful, endowing an ordinary PC with performance nearly equivalent to that of the AT.

Combining both of these system enhancements on a single board is more than enough reason to justify the introduction of two new products reviewed here: Orchid Technology's Turbo EGA and Sigma Designs' TurboCache EGA!. The two-in-one approach of these boards saves valuable expansion slot space that IBM was so niggardly in granting the lowly PC and also gives snappier on-screen performance.

The direct linkup of a high-speed processor and high-resolution graphics circuitry can in some cases actually update your screen display faster than a separate EGA board in an AT. An ordinary EGA board is limited by its 8-bit data bus interface, even when installed in an AT. These combination boards suffer no such bottlenecks.

Moreover, as replacement-style turbo products, they add no software complications and avoid most compatibility issues. Nearly everything that will run on an ordinary PC—including interpreted IBM BASICA programs—will race along with these turbos. The only error message generated by the 10-MHz Sigma board in turbo mode was caused by software products designed to be annoying: programs with key-disk copy protection schemes.

From the perspective of expansion board makers, these turbo-EGA boards bring another big benefit. With more and more features being incorporated into PC system boards, the market demand for ordinary multifunction boards is plummeting faster than sheep from trees. The prospects for turbo-EGA products, however, appear much brighter.

Nearly every one of the five or so million ordinary PCs plodding away on desktops across the country could benefit from the double-barreled improvements offered by these combination boards. As AT-level performance (and beyond) becomes the standard, there will be pressure on everyone who takes personal computing seriously to upgrade his system to a configuration that gives greater throughput and more graphics flexibility.

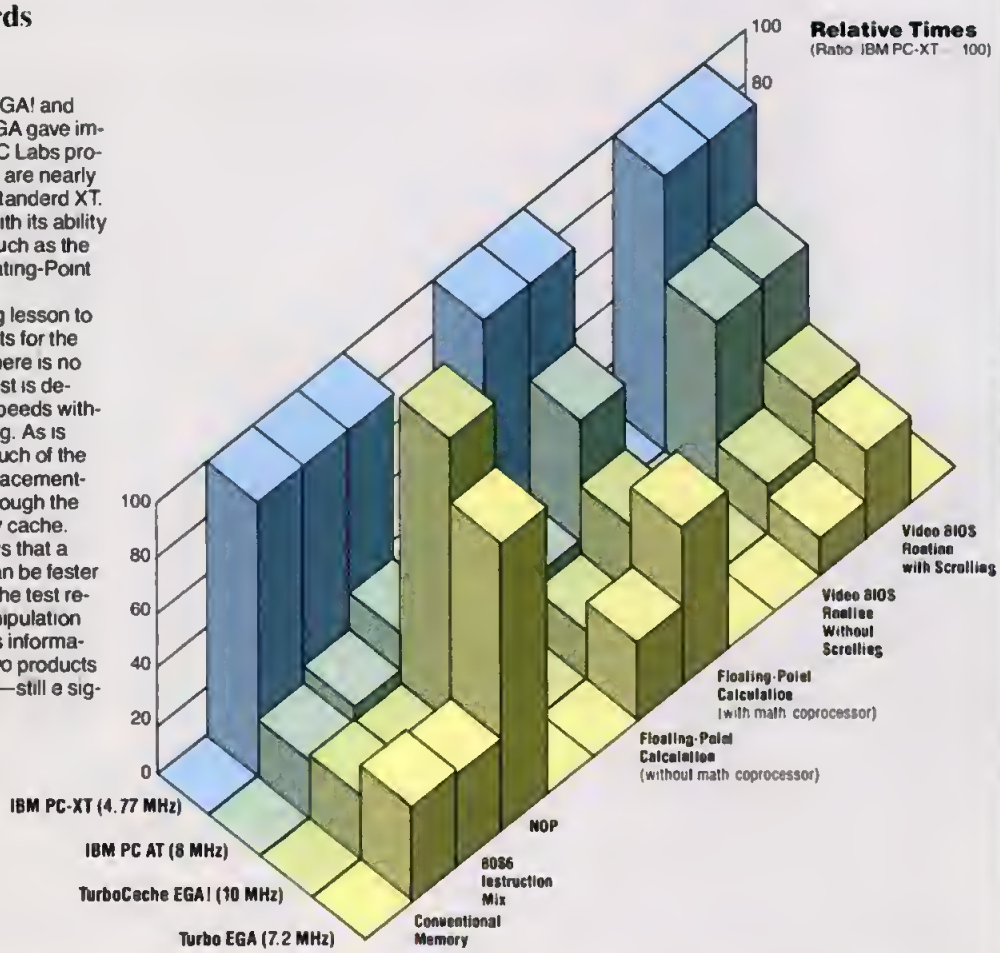
TWIN TURBOS This pair of turbo-EGA products ranks as twins in a number of aspects. Both are replacement-style tur-

Benchmark Tests: Turbo-EGA Boards

Sigma Designs' TurboCache EGA! and Orchid Technology's Turbo EGA gave impressive results on most of the PC Labs processor tests. These two products are nearly three to four times faster then a standerd XT. The TurboCache EGA! startles with its ability to race ahead of an AT on tests such as the 8086 Instruction Mix and the Floating-Point Calculation.

However, there is an interesting lesson to be learned if you look at the results for the NOP test. Here, and only here, there is no speed improvement. The NOP test is designed to show pure processor speeds without the benefit of memory caching. As is pointed out in the mein article, much of the speed improvement of these replacement-style turbo products is gained through the use of a static RAM chip memory cache.

The Video BIOS Routine shows that a turbo-EGA combination board can be fester than an AT with an EGA boerd. The test results shown here ere for text menipulation only. When using purely grephics information, the performance of these two products was comparable to that of an AT—still e significant improvement over an XT.



Performance Times
(Times given in seconds)

	Conventional Memory	8086 Instruction Mix	NOP	Floating-Point Calculation (without math coprocessor)	Floating-Point Calculation (with math coprocessor)	Video BIOS Routine Without Scrolling	Video BIOS Routine with Scrolling
IBM PC-XT (4.77 MHz)	5.9	32.0	10.1	159 2	4.9	11.8	17 5
IBM PC AT (8 MHz)	1.3	9 0	4.2	36 0	3.2	7 3	11 2
TurboCache EGA! (10 MHz)	1.4	7 3	12.7	28 3	2.1	2 1	6 1
Turbo EGA (7 2 MHz)	2.0	10 3	10 4	44 4	2.7	1.6	5.4

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records Then, 16,384 random records are read into and written from this memory The result shown is the average of the read and write times

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks The test program uses 8086 instruction code These instructions are a subset of the total processor instruction set

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions The benchmark program uses the floating-point library included with Microsoft C Compiler 4 0 Results are given for computations done with and without a math coprocessor

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling The test is performed in video mode 3 The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine This is done ten times The result shown is the total of the ten trials

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling The test is performed in video mode 3 The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display

bo products. Rather than just plugging into an empty expansion slot, they replace your PC's native 8088 microprocessor with high-performance circuitry.

Installing either board requires removing the 8088 or 8086 microprocessor from your PC or PC-XT, plugging the chip into a socket on the turbo-EGA board of your choice, then sliding a connecting cable into the vacant socket left behind on your system board.

Both manufacturers supply tools to assist you with chip removal. Although this operation is delicate, in many ways it is the best approach to enhancing system performance (see sidebar "Speed Bumps").

In both cases, the new brain is a member of the 80286 family. The Orchid Turbo EGA uses an Advanced Micro Devices 80L286-8, a lower-power-consumption version of the 80286 that's rated to run at 8 MHz. The Sigma TurboCache EGA! uses a faster chip, the AMD 80286-10, which is rated at 10 MHz.

Both manufacturers make use of the full capabilities of these enhanced processors. Sigma taps its chips for all it's worth, allowing you to run the TurboCache EGA! at a full 10 MHz. Orchid prefers to keep to a single oscillator and derives both a low-speed 4.77 MHz and a high-performance 7.2 MHz from the same time base—the former one-third and the latter one-half of the same frequency.

Both systems maintain complete compatibility with performance-sensitive and microprocessor-sensitive software by incorporating an ordinary 8088 in their circuitry (the one you pry out of your computer to install the turbo board). Both boards can be switched between native PC and turbo operation using a toggle switch on the card-retaining bracket.

Both also allow the addition of a numeric coprocessor to further enhance performance, although your chip choice options and coprocessor operating speeds vary between the twosome.

Both boards use high-speed cache memory to overcome the limited performance of the slow 8-bit memory of their host systems.

Both boards give a full EGA endowment, supporting all IBM video modes from monochrome to the top EGA standard with 256K bytes of video RAM and 640 by 350 pixels of on-screen resolution in 16 colors from a palette of 64. Both cards also offer compatibility with the Hercules monochrome graphics/standard.

And, strangely perhaps, both boards originate in Fremont, California.

Commonality, however, is not the whole story. Sigma Designs and Orchid Technology achieve the goal of turbo-EGA dual functionality, but with two different approaches.

ORCHID TECHNOLOGY INC.

Turbo EGA

Orchid Technology can credit itself with creating the first turbo boards—chiefly because it coined the term. Orchid was first to put the extra microprocessor to work on ordinary DOS chores with a high degree of IBM compatibility.

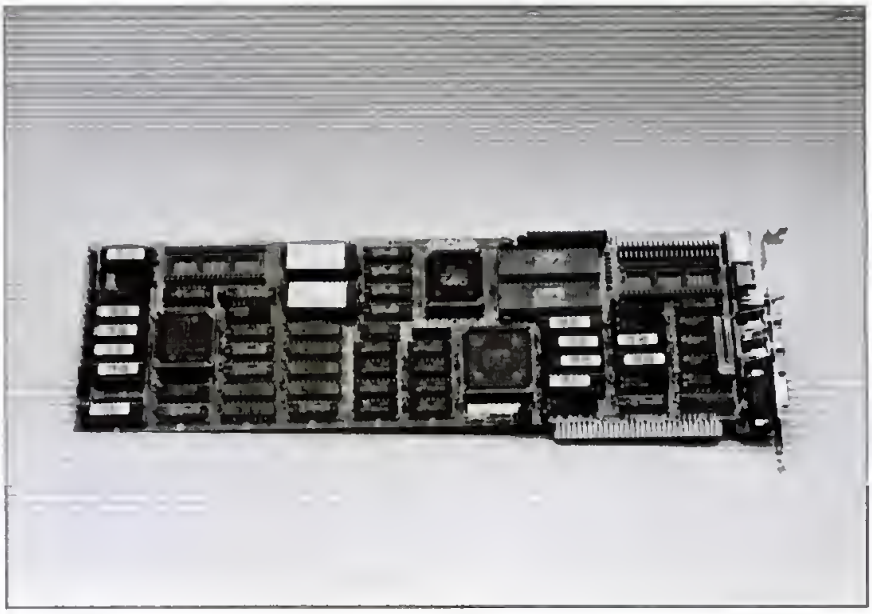
Today the company offers a wide range of performance-enhancing products for both PCs and ATs using both coprocessor and replacement processor architectures. Orchid products have been known for their smooth integration of display handling with turbo technology—a weakness of the turbo products of many other manufacturers—hence the turbo and EGA linkup of the Turbo EGA seems a natural addition to the product line.

In its nominal configuration, the Turbo EGA is a single full-length expansion board, 13½ inches long. As you would expect, it uses the conventional PC/PC-XT 8-bit data bus. It's also low enough to fit into an XT case because there's no reason at all to install it in a full 16-bit host such as an AT or compatible.

The Turbo EGA is slender enough to fit even the tightest full-length PC/PC-XT expansion slot. Although one on-board expansion connector lets you pile on a

PC MAGAZINE FACT FILE

Turbo EGA
Orchid Technology Inc.
45365 Northport Loop West
Fremont, CA 94538
(415) 683-0300
List Price: $749
Requires: 8088-based computer.
In Short: A well-executed replacement-style turbo board with 7.2-MHz 80286 performance and an 8K static RAM cache. By cohabiting the same board, the Chips and Technologies–based EGA enhancements benefit from the increased processor speeds.
CIRCLE 686 ON READER SERVICE CARD



Orchid Technology's Turbo EGA board offers 7.2-MHz speed, and a socket for an 80287 coprocessor is included. Its EGA capabilities are based on Chips and Technologies' EGA system.

Photograph: Thom O'Connor

THE ADVANTAGE

ENHANCED

Kaypro Corporation — electronics innovator since 1952 — has made a good thing even better. The KAYPRO 286i Model C now features a 40-MB hard drive and the 101-key AT-style keyboard. With the latest standard feature enhancements, the KAYPRO 286i is the smartest choice in advanced computer technology.

Advanced.
The heart of the KAYPRO 286i is the 80286 microprocessor — with a processing rate of 10 MHz and 640 kilobytes of RAM. The perfect match for today's high productivity software.

And Enhanced.
The KAYPRO 286i Model C has a 1.2-MB floppy disk drive, plus a hard disk with 40 MB of storage. The KAYPRO 286i AT-style keyboard features the new 101-key layout with separate cursor control, numeric keypad, and 12 programmable function keys.

Perhaps the nicest surprise about the KAYPRO 286i/C is the suggested retail price of $2995.

You won't find distinctive metal construction, 10-MHz processing, and free name-brand software that includes WordStar Professional Release 4 in any other AT-type computer. Other company's extras are Kaypro standard features.

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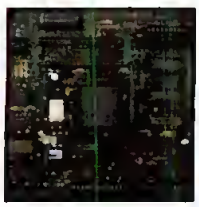
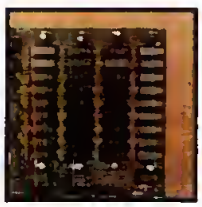
The KAYPRO 286i Model C features...



80286, 10-MHz Microprocessor.

An internal hard disk drive with 40 MB of storage.

Enhanced 101-key IBM PC/AT-style keyboard with security keylock.



640 KB of RAM; expandable to 15 MB.

Bundled software includes WordStar Professional Release 4.

Trademarks: 286i, Kaypro Corporation; IBM, AT International Business Machines, WordStar Professional Release 4, MicroPro International.

For the Kaypro Dealer near you, call 1-800-4KAYPRO.

made in U.S.A.

CIRCLE 343 ON READER SERVICE CARD

daughtercard for enhanced EGA features, in most systems this option will not be used.

Despite the holistic concept behind the design of the Turbo EGA board, its circuitry is segregated into two distinct areas corresponding to its two functions.

Concentrated near the center of the card is the EGA section, consisting mostly of the Chips and Technologies EGA implementation. Video RAM is eight 150-nanosecond, 256K-bit DRAM chips soldered to the board.

Opposite the card edge connector is most of the turbo circuitry: the processor, its added ROMs, and six high-speed, 55-nanosecond static RAM chips that yield 8K bytes of cache. A full dozen programmable logic arrays located in two groups of six (one group for each board function) convert the off-the-shelf components to their proprietary purposes.

■ The overall design of the Orchid Turbo EGA is refined, and its execution is elegant.

At the top of the board near the turbo circuits is a socket for an 80287 coprocessor. Close by is a jumper that allows you to select either 5- or 8-MHz operation for this chip, giving you the flexibility to buy a coprocessor in the speed rating you can find or afford.

INSTALLATION Before installation, several jumpers must be set to match the Turbo EGA to its host system. One group is used to specify the amount of host memory, from 64K to 734K. Another jumper enables or disables the high-speed cache circuitry (the default is enabled). Still another jumper must be moved should the Turbo EGA be plugged into a standard monochrome or CGA-compatible RGB monitor rather than an EGA display.

A couple more jumpers are available for adjusting the board for compatibility with unusual systems. One moves the port addresses that it uses to a lower range (but complicates the use of EGA), and another disables the Turbo EGA's use of the host's nonmaskable interrupts. Unless you own accessories that require the same port addresses as the turbo-EGA board, you should not have to fool with these settings.

As with nearly all EGA boards, the Orchid board has a cutout in its retaining bracket through which a bank of four DIP switches peeks out, allowing you to access the switches for the monitor you plug into the board and other display adapters that are used in the system. Also available on the retaining bracket are two RCA phono jacks for special EGA features (not composite video) and a female DB-9 jack for connecting a monitor.

A toggle switch on the retaining bracket allows the selection of the operating speed of the Turbo EGA between native 8088 mode and 7.2-MHz 80286 mode. Flipping this switch while the system is in operation halts processing, causes a 2-second pause, and then performs a cold reboot. In that this is the only speed control available, you obviously won't want to change horsepower in mid-datastream.

This switch can be even more vexing because some systems may not boot at turbo speed—at least according to an Orchid addenda sheet. Although our plain-vanilla IBM PC had no problem, persnickety processors will require you to switch them on in native mode, then flick the switch to speed everything up—an added inconvenience that no one will likely enjoy.

Orchid does supply a disk of software, but none of it is aimed at the board's turbo functions. One set of programs duplicates the functions of the Hercules support software, enabling the various monochrome/graphics modes, and provides for special CGA or monochrome emulation modes. Another utility is supplied to save your screen, blanking your display after a period of system activity that you can set in 1-minute increments up to 9,999 (that's almost a week—your monitor may be gasping by that time!).

TEST PERFORMANCE Benchmark-testing put the Turbo EGA's performance near that of an 8-MHz AT, giving nearly a sixfold performance increase on some tests. On the average the Turbo EGA completed the benchmark tests 67 percent faster than would an un-turboed XT. Of course, it's held back from giving this measure of performance in all applications by the limitations of its caching system. Compared with an AT, data transfers from disk will also be more leisurely because of the 8-bit I/O constraints of the host PC.

Two words describe this board's EGA abilities: quick and clean. When running the PC Labs Video benchmark test, it was faster than an AT/EGA combination. The board adds no irritations of its own—not even a trace of flicker when running in CGA mode.

The overall design of the Turbo EGA is refined, and its execution is elegant. Although the Turbo EGA won't make a PC into a Personal System/2 or even an AT, it will add new vigor to an old system.

SIGMA DESIGNS INC.

TurboCache EGA!

Sigma Designs' entry takes a two-tiered approach to joining turbo and EGA functionality. Built on the foundation of Sigma's standalone speed enhancement, the TurboCache 286, the TurboCache EGA! gains EGA abilities when mated with an EGA! Stack daughtercard. The underlying card requires a full-length expansion board that uses the 8-bit XT data bus. When double-decked, it spreads only three-quarters of an inch—a tight fit in an PC/PC-XT slot, but a fit nonetheless.

Notwithstanding the add-on approach, EGA support is an inherent part of the TurboCache 286. Its retaining bracket holds a full endowment of EGA connectors and switches, including a female DB-9 for plugging in your display, two RCA-style phono-cum-video pin jacks for special EGA features, and a cutout through which you can access a bank of four DIP switches for selecting monitor type. In addition, a light pen connector (the usual row of gold pins) is located about midway down the length of the board.

The daughtercard that furnishes the actual EGA abilities is 5 inches long and attaches cheek-to-cheek—component side to component side—to the TurboCache. A second daughtercard, presumably equally

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CIRCLE 734 ON READER SERVICE CARD

thick but not sent for review, can be plugged into the TurboCache to add whatever special features take advantage of those ubiquitous pin jacks on the TurboCache board.

The daughterboard approach adds an extra degree of flexibility to the TurboCache system. You can plug in another video board—the Sigma Color 400 Stack—in place of the EGA! Stack card to gain enhanced CGA abilities: a double-scanned 400-line maximum vertical resolution.

The Color 400 Stack gives you an interim solution of better (and faster) displays without the need to go all the way to EGA. (Of course, the Sigma EGA will operate a CGA display just as will any other EGA board.)

DESIGN SECRETS The TurboCache 286 received for review proved to be a product of what undoubtedly is the most paranoid engineering staff in the world. Every chip on the board, except for the microprocessor and ROMs, had all identifying marks removed—not just painted off, but gouged away by some security fanatic.

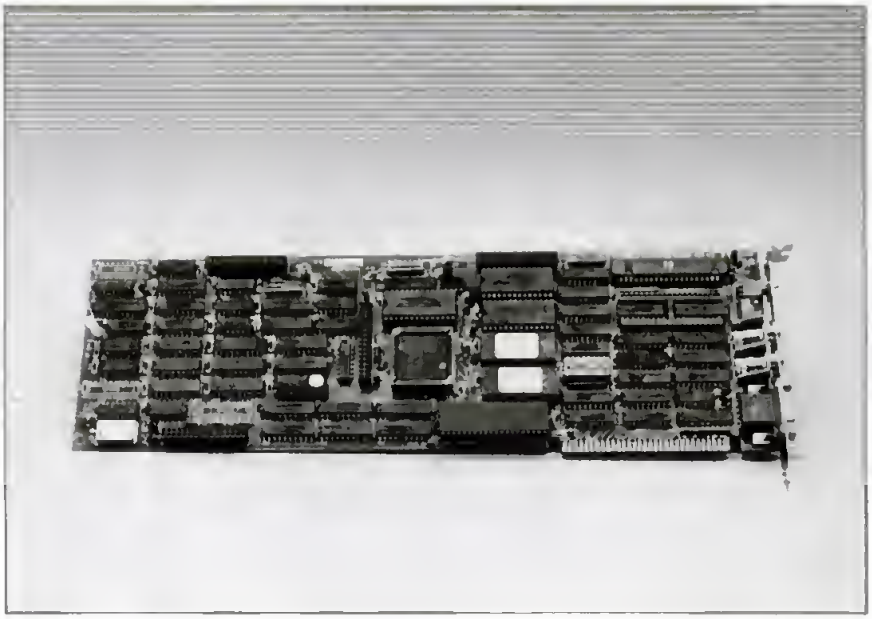
Maybe there's something to be said for keeping design details secret, what with Sigma and Orchid both in Fremont and carbon paper engineering being the darling of the '80s. But the effort is inappropriate and just plain stupid. Anyone serious about reverse-engineering the product will just x-ray the board and be done with it.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

TurboCache EGA!
Sigma Designs Inc.
46501 Landing Pkwy.
Fremont, CA 94538
(415) 770-0100
List Price: $899 (separately: TurboCache 286, $649; EGA! Stack, $349).
Requires: 8088-based computer
In Short: Don't let the piggyback style of this board confuse you. TurboCache EGA! is a turbo board that fully supports the Chips and Technologies EGA implementation. This replacement-style turbo board has 10-MHz 80286 performance and a 16K static RAM cache.

CIRCLE 587 ON READER SERVICE CARD



Sigma Designs' TurboCache EGA!, with its 10-MHz speed, outperformed the Orchid Turbo EGA and an IBM PC AT. Jumper settings allow you to choose from several speeds.

Amid the tight rows of nameless semiconductors on the TurboCache, you'll find a socket in which to plant the 8088 that you must uproot from the host computer. In addition, the TurboCache 286 board also reserves an empty socket for an 8087 numeric coprocessor chip.

Despite the gouged chips, Sigma Designs supplies instructions for upgrading the on-board cache memory from 16K to 32K. But this alteration requires that three new high-speed static RAM chips replace three existing chips. Sigma helpfully specifies three alternative products that will work for this purpose.

The performance of the TurboCache can be optimized by setting two pairs of jumpers; these determine its operating speed, allowing you to match the speed of just about any 80287 math coprocessor you can dig up. You've got four choices: 5 MHz for an 80287-3; 5.7 MHz for an 80287-6; 8 MHz for an 80287-8; and 10 MHz for an 80287-10.

Unlike the TurboCache 286 foundation, none of the components on the EGA! Stack board have been defaced. Everything is pretty much the standard Chips and Technologies EGA implementation.

Apart from the coprocessor settings, installing the TurboCache EGA! requires at most three adjustments: two to the add-in board and one to the host PC.

Using a single bank of eight DIP switches, you can set the base address of the ports used by the board to avoid conflict with other peripherals. Ordinarily, however, the factory settings won't require a change.

The other settings you must make are the same as those required whenever you add an EGA to a PC. You must configure the host's DIP switches to reflect no monitors being installed, then set the switches peering through the TurboCache retaining bracket to the video mode and monitor that you want to use—EGA, Monochrome, 40-column CGA, or 80-column CGA—and any other monitor that might also be cohabiting in the system.

TOGGLE SWITCH As with the Orchid Turbo EGA, Sigma Designs includes a toggle switch on the rear panel of the TurboCache that allows you to select between the 8088 microprocessor and the turbo speed of the 80286. As with the Orchid board, flipping the switch during operation reboots the host computer.

Once you're in turbo mode, you're really moving fast. The TurboCache EGA! whipped through the PC Labs

benchmark tests, beating the Orchid entry and even the IBM 8-MHz AT on several of the tests. Overall, the TurboCache EGA! completed processor tasks 25 percent faster than a straight XT.

Sigma Designs also wisely includes a software utility that switches the operating mode of the TurboCache, even within applications. The program, called simply Turbo, is run once and remains partially RAM-resident, intercepting keyboard input. Pressing the Ctrl-Alt-Plus key combination switches to turbo; Ctrl-Alt-Minus flips to 8088 mode. In addition, these functions can be handled by running Turbo again at the DOS prompt.

PC MAGAZINE EDITOR'S CHOICE

- **TurboCache EGA!**

Once I overcame my aversion to stack boards and blackened chips, the TurboCache EGA! proved to be a worthy system addition. On several benchmark tests, its 10-MHz brain outthinks IBM's best AT and beats Orchid Technology's Turbo EGA on a majority of the scores.

If you look at the screen and not at the board, Sigma Designs' TurboCache EGA! ranks the better product and the better buy.

Again like Orchid, Sigma warns that booting in high-speed mode may not be successful. We encountered no problems with DOS 3.2 but, inexplicably, cold booting in 80286 mode and DOS 3.1 resulted in our keyboard undergoing a strange shift: every character, including numbers and carriage return, shifted to the equivalent of uppercase (1 appeared as !, 2 as @, etc.). Booting in 8088 mode and running the Turbo program easily eliminated the puzzling problem.

Sigma lets you handle setting all Hercules and video mode compatibilities in one utility program, SIGMAEGA, which also operates as a screen blanker (with the delay period selectable up to 1 hour). And just in case you want to try high-speed doodling with your new system, Sigma throws in the *PC Paintbrush* package.

The TurboCache EGA! produces video with snap and sparkle, vying with Orchid for speed and equaling it in quality.

SHOULD YOU BUY ONE?

As they stand, these turbo-EGA boards are amazingly good—a leap beyond the first generation of turbo products. But the question remains, whether to buy one of these products at all.

Neither of these products will turn a PC or XT into a Personal System/2, nor even a now old-fashioned AT. The actual improvement in program throughput that you'll get will depend on how well your applications and the cache memory of the boards hit it off. (In theory at least, the bigger cache of the TurboCache EGA! should give it an even greater advantage over the Turbo EGA.) But disk performance will lag: don't even think of toying with either of these turbos until you've stuffed a hard disk under the hood of your PC.

In light of IBM's April product introductions, these enhancements—wonderful only a few months ago—now rank only as interim solutions. When IBM upped the display standard to 640 by 480 pixels with 256 colors, mere EGA lost the crown as the reigning beauty of video resolution.

That makes their prices perplexing, at best. Compared with an IBM EGA board, these turbo-EGAs are bargains indeed—you essentially get the turbo performance thrown in for free. On the other hand, their retail tickets put them temptingly close to the cost of a stripped AT compatible (to which you can presumably add your old display system and a pair of bifocals). You could get a whole new system and give the PC to your college-bound offspring or keep the spare PC on the shelf.

Moreover, if you are after the highest quality and snappiest monitor performance, you've got to give up the quest for the lowest price and look at something that currently comes only with an IBM label.

Nothing inherent in these turbo-EGA boards should put you off. They handle their appointed duties well and will breathe new life into an aging system. You only have to decide whether that is what you want to do. PC

Winn L. Rosch is a contributing editor of PC Magazine.

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If you're new to dBASE, dBXL INTRO lets you run the program with menu choices. A "tutor" line simply shows you which dBASE III Plus command you're creating with the menu. If you goof, error messages are simple and easy-to-understand, and two levels of *Help* are just a function key away. Even our documentation is easier; it's better written, better organized, and more concise.

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dBASE Power Tools

Maximizing dBASE performance is a significant challenge that is begin met by a growing list of compiler and interpreter programs designed to speed dBASE power users along.

Ashton-Tate's competitors have been carving out a market niche by taking advantage of shortcomings in its giant *dBASE* database management system. The upstarts are offering products that can benefit both applications developers and end users: *dBASE* language compilers for developing customized *dBASE* applications and *dBASE* interpreters for interactive access to the information stored in *dBASE* databases.

Native-code compilers and pseudo-compilers that can execute *dBASE* language commands are designed to remedy *dBASE*'s drawbacks as an applications development tool. Geared primarily for the serious developer, their major contribution is executing *dBASE* code faster. They often offer improved debugging facilities as well. And they have extended the *dBASE*

language with powerful enhancements that make programmers more productive and the programs they create more functional and attractive.

Generally, *dBASE* language compilers do not require the developer to buy *dBASE* or one of the run-time modules Ashton-Tate designed to make up for *dBASE*'s slow speed. They also eliminate the extra cost of a copy of *dBASE* for the end user.

Ashton-Tate's competitors have also introduced new interpreters priced lower than *dBASE*. These interpreters allow users with more modest data management needs—and more modest budgets—to enter the *dBASE* community and gain interactive access to database information.

We look at four of these *dBASE* competitors here: *Clipper*, a native-code compiler from Nantucket Inc.; *dBXL*, an interpreter from Wordtech Systems; *FoxBASE Plus*, a pseudocompiler from Fox Software; and *Quicksilver*, a compiler with a native-code optimizer from Wordtech Systems.

DBASE DOMINANCE In one sense, these competitive products simply add to the credibility of the *dBASE* language and strengthen Ashton-Tate's long-term position. According to Dataquest's Paul Cubbage, in 1986 Ashton-Tate earned a 45 percent share of revenues and a 35 percent share of unit sales among all microcomputer database managers, including the Apple Macintosh family as well as PCs and compatibles. The *dBASE* language compilers and interpreters evaluated here generated perhaps $15 million—10 percent of Ashton-Tate's $150 million 1986 database revenues.

Ashton-Tate's database management system has had three major releases: the initial *dBASE II*, *dBASE III* when the PC standard became established, and *dBASE III Plus*, the current version. Each has added more functionality, greater ease of use, and better documentation.

TWO USES *dBASE* is both an interpreter and an applications developer. As an interpreter, it allows interactive access to the information stored in its databases. As a programming environment, it is used to develop customized *dBASE* applications.

Since the original concept of command files seemed in some ways to be merely a method of storing a sequence of commands so you wouldn't have to type them again, *dBASE*'s language capabilities were once debated. But even in *dBASE*'s first incarnation, commands for branching and constructing loops allowed you to create programlike command files that performed functions traditionally associated with high-level languages. Certain of its commands were high level, sometimes executing with one line what would take dozens of lines of code in more-traditional languages.

Over time, the debate has evaporated. Ashton-Tate and others expanded *dBASE* to the point where no one questions its status as a legitimate programming environment.

As an applications development tool, though, *dBASE* has some flaws. It executes slowly as an interpreter. And since few developers wish to provide the source code to their applications, the cost of buying a copy of *dBASE* jacks prices up for the users, too. Ashton-Tate has developed less costly run-time interpreters that hide the source code from the end user, but these too run at less than warp speed.

Ashton-Tate refuses to discuss future products, but it's fair to assume we'll see further developments in the *dBASE* family, perhaps along the lines of graphic interfaces and some foray into the SQL (Structured Query Language) standard that may filter down to microcomputers from mainframes and minis.

TWO BENEFICIARIES The ultimate beneficiaries of these developments are *dBASE* end users, as well as developers of applications software and the competing products they will undoubtedly spawn. Both camps have enjoyed improved performance and flexibility as *dBASE* and its competing products have evolved to the current level of sophistication. The future promises more of the same.

Clipper

Nantucket's *Clipper* is a native-code *dBASE* language compiler designed primarily for software developers. Its fast execution speed and its language extensions have won it support among developers.

EDITOR'S CHOICE

PC MAGAZINE

FACT FILE

***Clipper*, Autumn '86 Version**
Nantucket Inc
5995 Sepulveda Blvd.
Culver City, CA 90230
(213) 390-7781
List Price: $695; upgrade, $139 for registered owners.
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: A native-code *dBASE* language compiler designed primarily for software developers with fast execution speed and many language extensions. Not copy protected.

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The most recent release, designated Autumn '86, continues in the Nantucket tradition of adding still more bells and whistles to the *dBASE* language. And the company has finally removed all copy protection from *Clipper*.

Clipper is a traditional two-step compiler. First, you prepare your source code with the text editor or word processor of your choice and compile it with the *Clipper* compiler, which normally compiles all program modules in an application, producing an object file. The second step links your object file with routines extracted from *Clipper*'s main library and other specialized object libraries.

The result is a freestanding program that you can execute directly from DOS. You don't need a run-time module or a copy of *Clipper* or *dBASE* to run the final applications program.

Nantucket supplies a customized version of the PLINK86 linker, but you can use current releases of the standard Microsoft linker in some situations. Although PLINK is much slower than the Microsoft linker, it alone lets you structure overlays to reduce the memory required in the computer on which the application will be executed. Implementing overlays is never a trivial process, but *Clipper*'s PLINK methods are not quite as Byzantine as some.

As with any similar compiler, *Clipper*'s constant edit-compile-link-execute cycle can get tedious. You also lose the relative

```
LIST PREDIT.PRG

IF scantype $ 'NCA'

  IF scantype = 'A'
    sequence = ' '
    @  8,8 SAY 'N>ame or C>ompany sequence ===> ' GET sequence ;
      PICTURE '!' VALID sequence $ 'NC'
    READ
    IF sequence = 'N'
      USE prdata INDEX lastname
    ELSE
      @ 10,8 SAY 'Indexing...'
      INDEX ON company+lastname TO company
      USE prdata INDEX company
    ENDIF
  ENDIF scan all records

  IF scantype = 'N'
    USE prdata INDEX lastname
    @  8,8 SAY 'Enter Last Name to Edit (F5 to quit) ===> ' GET mlastname
    @  9,8 SAY 'Enter First Name ===>                    ' GET mfirstname
    READ

Command>                    Key: ↑↓←→PgUp PgDn Home End X=exit ?=Help
```

Clipper *employs a traditional, two-step programming process. Programming code, such as the sample above, is written and edited in your word processor and then run under* Clipper.

ease of debugging your code in an interpreter. Yet Nantucket supplies a reasonably competent debugger that you can link into trial programs to help ferret out problems in your code.

EXTENSIVE EXTENSIONS While *Clipper*'s initial appeal was based on its execution speed, the many language extensions Nantucket has added have seduced developers. The extensive list makes covering even the high points difficult in a single review.

Since *Clipper* lets you define up to eight relations among files (compared with only one in *dBASE III Plus*), you can structure complex data interrelationships easily. Also, *Clipper*'s help system is seamless and professional. The F1 key calls a Help program you can write to give end users general or context-sensitive on-screen help. When a user presses F1, *Clipper* sends the name of the program module being executed, the current line number, and the name of the memory variable waiting for user input. The help program you write can save the current screen, display help messages, and restore the saved screen image without redrawing code.

You can add *Clipper*'s VALID clause to GET input statements. The program tests user input against an expression you specify and rejects input that doesn't satisfy your expression, saving you from having to do tedious loop coding to ensure acceptable input. Another timesaver is a series of commands that implements attractive lighted-bar menus with no more code than static *dBASE* menus require.

Clipper implements an additional loop construct not found in *dBASE*. If you know the number of iterations in advance, FOR . . . NEXT . . . STEP loops, used just as in BASIC, can be more straightforward than using DO loops. *Clipper*'s new release supports arrays, but they are only one-dimensional.

Memo fields have long been something of a stepchild in the *dBASE* system. *dBASE III Plus* offers limited, handicapped access to memo fields and manages them poorly. *Clipper* adds several functions that finally make memo fields immensely useful. It lets you display and edit memo fields in a screen window or assign memo fields to a standard string for searching and other manipulations. Although *Clipper*'s memo field support system is poorly documented, it rewards experimentation.

Perhaps *Clipper*'s most notable innovation is the concept of User Defined Functions. You can write code segments that your program can call just as it would the standard functions supplied with *Clipper*. Your functions essentially become extensions to the *dBASE/Clipper* language, with the same status as built-in functions.

Clipper doesn't support most of the *dBASE* commands that you would normally use only in an interactive environment (like BROWSE, EDIT, and DISPLAY MEMORY). Occasionally you'll miss access to these commands, even though clever programming can work around them.

UTILITIES Nantucket supplies several utility programs with *Clipper* that perform functions you would execute interactively within *dBASE*. CREATE, LABEL, and REPORT programs simulate equivalent *dBASE* commands. INDEX creates *Clipper* index files. The special .NTX indexes that *Clipper* creates and requires have long been a bone of contention. If you want to manipulate data files with *dBASE*, you'll need to reindex from *dBASE* to create normal .NDX files. Nantucket claims its index structure is more efficient and faster than *dBASE*'s, but it has announced compatible index structures in an upcoming release.

Clipper now includes statements that let you modify your code to execute on networks that support DOS 3.1 calling conventions. The *Clipper* networking commands are similar to those in *dBASE III Plus*. Your application doesn't need any costly network access modules akin to those sold by Ashton-Tate for *dBASE* network access.

SPEED *Clipper* acquitted itself quite well in our tests. The compilation and linking process, however, is slow. A Make utility can eliminate unnecessary recompilations, and I highly recommend Comtel's excellent, simple, and inexpensive CLMAKE. Execution times, on the other hand, are fast. In general, *Clipper* ran a solid second to *FoxBASE Plus* on most of the PC Labs tests, although it beat *FoxBASE Plus* on one and lost to *Quicksilver* on another.

Nantucket plans a Spring '87 release

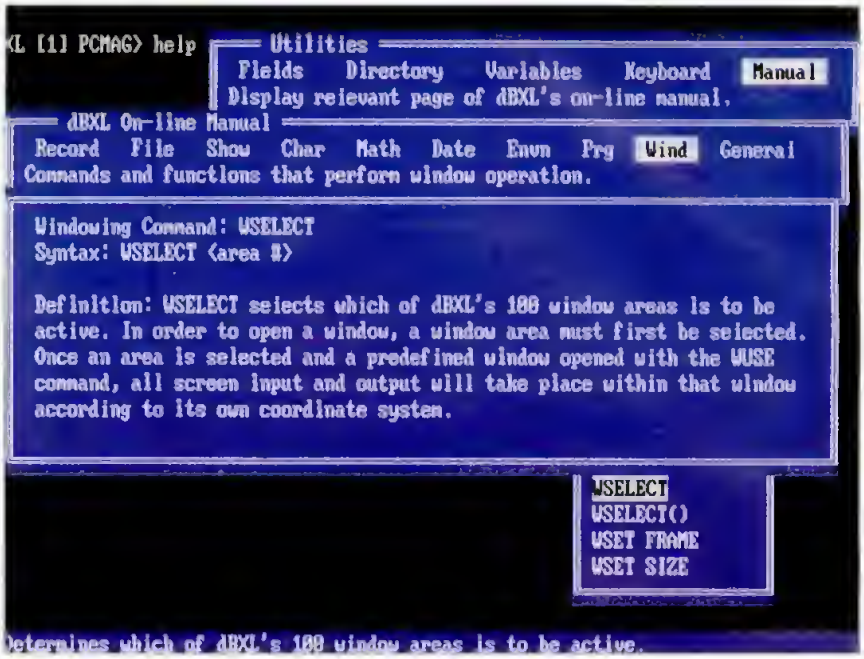
sometime in May. This free upgrade will fix a few bugs, but its main aspiration is to improve performance still further. *Clipper* was king of the performance hill since its introduction, but now healthy competition from *FoxBASE Plus* and *Quicksilver* may lead to even faster execution times. The new release will, as mentioned, also support *dBASE*-compatible index file structures.

Clipper has established a very strong loyalty among *dBASE* applications developers. Its many extensions and its speed have earned *Clipper* solid sales that should continue to grow.

dBXL

Like *dBASE III Plus*, Wordtech Systems' *dBXL* is an interpreter. It has all the advantages of an interpreter when it comes to interactive processing—and the disadvantages in execution speed. In itself, another *dBASE* interpreter wouldn't be all that exciting. The big news with *dBXL* is its $169 price—75 percent less than that of *dBASE III Plus*. But there's more to *dBXL* than low cost.

According to Wordtech, *dBXL* is designed to be "a functional twin of *dBASE III Plus*." For the most part, it meets this design objective nicely, but it implements some *dBASE* commands differently and doesn't support a few of *dBASE*'s offerings. Also, it has several interesting and useful language extensions. Unlike most other *dBASE* clones, *dBXL* doesn't have its own index file structure, so you can use standard *dBASE* data and index files as is.



dBXL*'s sophisticated and extensive on-line manual helps to guide you through the program's functions. In this example, the command WSELECT is being explained.*

Unlike *dBASE*'s notorious dot prompt, *dBXL*'s prompt tells you which work area you're currently using. Many *dBXL* commands that require continuous input from the operator use *1-2-3*–style horizontal menus. The program displays pop-up subwindows to add further information or to display available options.

EASY CORRECTIONS AND HELP

dBXL's built-in program editor works well enough, but it doesn't resemble the *dBASE III Plus* editor visually. The *1-2-3*–style menus are both a help and a hindrance. For example, you have to hit several keystrokes just to write your program to disk. On a brighter note, *dBXL* adds a Fix alternative to the normal "Cancel, Suspend, Ignore" options presented when a program error is encountered. If you choose Fix, the editor appears with the cursor positioned near the error, and you can make whatever corrections are needed. When you leave the editor, the program resumes execution with the corrected line. The appearance of this fast and convenient correction system in the *dBASE* community, available for years with various programming languages, is welcome.

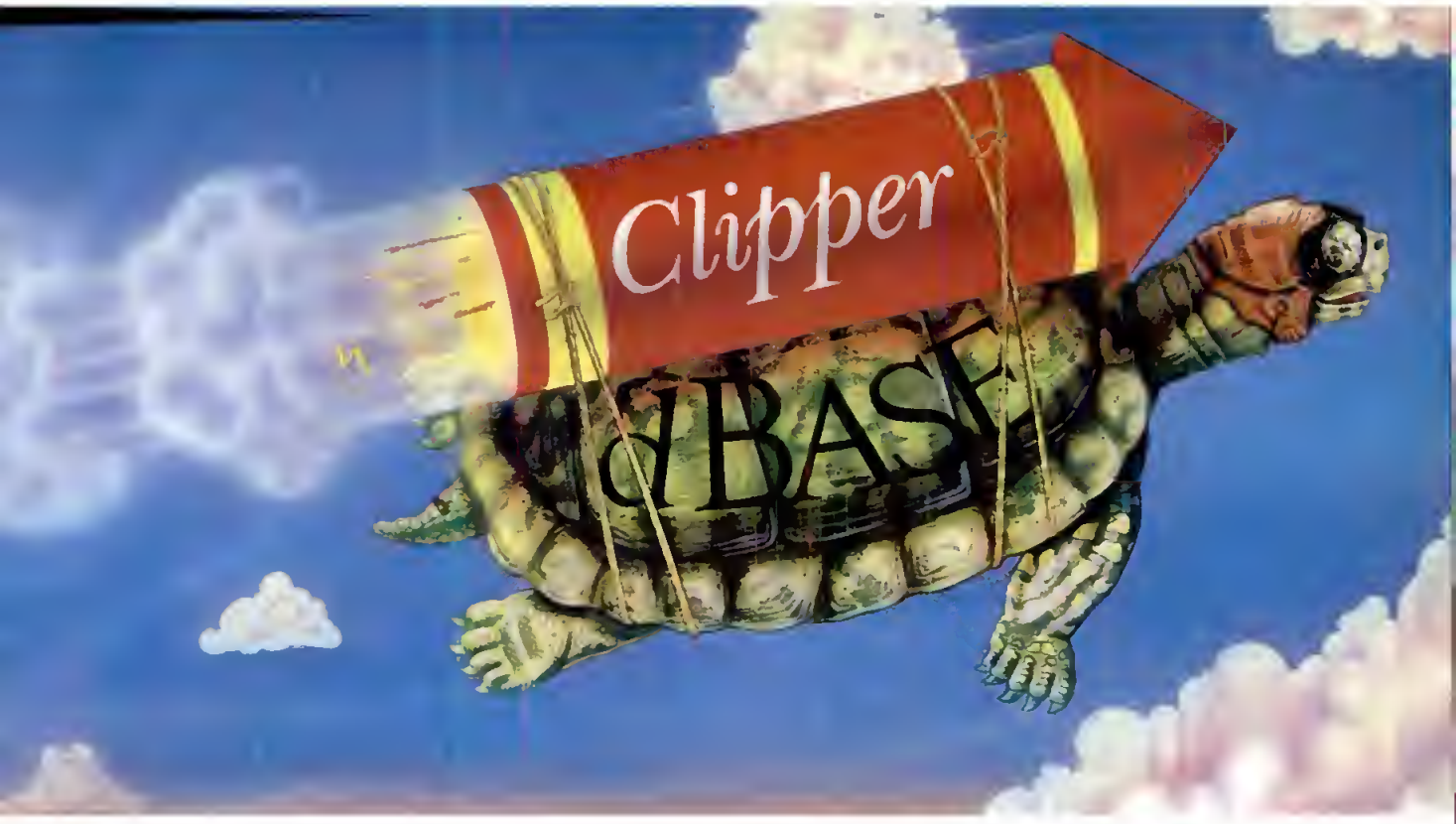
dBXL features a superb context-sensitive Help system. You can display fields in the active database, directories of files and databases, or a list of memory variables, as well as an on-line manual. However, citing the printed manual page on the help display would also help. A new, clever, but poorly implemented HELP clause lets you append a string to an @ SAY/GET statement. If the user hits F1 while inputting to the GET, the string is displayed in a small box in the upper right of the screen. But the help message isn't word wrapped or otherwise formatted, and the message box size is fixed no matter how long the help text is. You can count characters and add extra spaces, but this method is obviously tedious and unacceptable.

EXTENSIONS One of *dBXL*'s major additions to the *dBASE* language is an AUTOMEM mechanism that can automatically create special memory variables for each field in the active database. Other AUTOMEM commands add a new record to a database and fill it with the contents of the special variables, fill the variables with the contents of fields, and more. AUTOMEMs are both faster and easier to pro-

FACT FILE

dBXL
Wordtech Systems Inc.
P.O. Box 1747
Orinda, CA 94563
(415) 254-0900
List Price: $169
Requires: 512K RAM, two disk drives, DOS 2.0 or later
In Short: An interpreter that offers good *dBASE* compatibility and useful extensions at a remarkable price, but isn't exactly a speed demon. Not copy protected.

CIRCLE 679 ON READER SERVICE CARD



Turtle Souped

If it seems that the more you have to do, the slower your database wants to do it, there's a very simple solution.

The Clipper™ compiler from Nantucket.

Just run your dBASE™ applications programs through Clipper and watch them fly. Then as your business grows, Clipper will grow with you.

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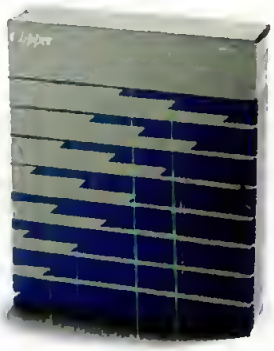
And once your programs are compiled, you can distribute as many copies as you like with full source code security and no licensing or runtime fees.



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Or call (213) 390-7923 today.

Clipper can put you on the fast-track today.

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gram than traditional methods based on REPLACE.

dBXL allows more intimate contact with DOS and the computer's hardware than *dBASE*. IN and OUT commands let you access hardware ports, and a new DOSINT command calls an interrupt service routine for access to low-level DOS and BIOS services.

The other main language extension is a comprehensive windowing system (pioneered by *Quicksilver*) that lets you create pop-up windows for a variety of purposes, including input and output and help messages. Text scrolls within an active window. You can display up to 99 windows simultaneously and expand, contract, and move them easily.

The syntax of the windowing commands closely mirrors normal *dBASE* data file commands. The commands include WABANDON, to deselect the current window but not release the window opened in it; WCLOSE, to erase the window and its contents; WCOPY TO, to copy a window definition into a new area; WDISPLAY, to clear and display a window; and so on, with commands to move, release, restore, save, select area, define frame, change size, define title, define window, open a master file with multiple window definitions, and open a window in the currently active window area. The powerful, flexible windowing scheme is also easy to learn and use.

dBXL is highly compatible with *dBASE III Plus*, but it doesn't implement some of the newer *dBASE* systems like View, IMPORT/EXPORT, and the *dBASE* screen painter. *dBXL* replaces *dBASE*'s ASSIST system for beginners with a similar but not identical INTRO system. It also has no network support whatsoever.

For some reason, memory-variable names can be only eight characters long, instead of the ten characters that *dBASE* permits. This difference could create problems when moving programs written for *dBASE* to *dBXL*.

dBXL's documentation is simply the best of any *dBASE* language system. It has useful tutorials and beautifully written explanations of each command and function. I routinely reach for it as a command reference, no matter which interpreter or compiler I'm using.

SPEED Just about the only thing that's not impressive about *dBXL* is its execution speed. It was by far the slowest product on every test we ran, and Wordtech plans to increase execution speed in future releases. Unlike its sister product *Quicksilver*, *dBXL* ran our tests with no modifications. *dBXL* offers good *dBASE* compatibility and useful extensions at a remarkable price. Not surprisingly, initial sales results have been excellent. Two major markets will most likely emerge for *dBXL*: those who want access to the tremendous body of *dBASE* software, books, and courses but resist Ashton-Tate's high prices, and users of compiled applications who need to access their data interactively from time to time. While *dBXL* isn't exactly a speed demon, it can meet the needs of both segments quite nicely—at a hard-to-beat price.

FoxBASE Plus

FoxBASE Plus, from Fox Software, is an exciting pseudocompiler that offers both execution speed and the comfort of the traditional *dBASE* environment. This form of compilation has been regarded as slower than native-code compilers, but speed isn't a problem with *FoxBASE Plus*.

EDITOR'S CHOICE

PC MAGAZINE

FACT FILE

FoxBASE Plus
Fox Software Inc.
27475 Holiday Ln.
Perrysburg, OH 43551
(419) 874-0162
List Price: $395, single user; $595, multiuser.
Requires: 512K RAM, two disk drives, DOS 2.0 or later.
In Short: An exciting pseudocompiler that offers both execution speed and the comfort of the traditional *dBASE* interactive environment. Disks not copy protected, but unlocking codes are necessary.

CIRCLE 678 ON READER SERVICE CARD

FoxBASE Plus is hungry for memory. Its performance improves as more RAM is available, up to optimal performance at around 520K bytes of free memory. *FoxBASE Plus* senses an 8087/80287 math coprocessor if one is present, and its performance improves then as well. The distribution disks are not copy protected, but you must use unlocking codes to operate them. The disks include codes that configure *FoxBASE Plus* for demonstration purposes. If you decide to keep the pro-

This FoxBASE Plus *help screen contains listings under the category of Functions Environment. The on-line help is a good supplement to the program's rather Spartan documentation.*

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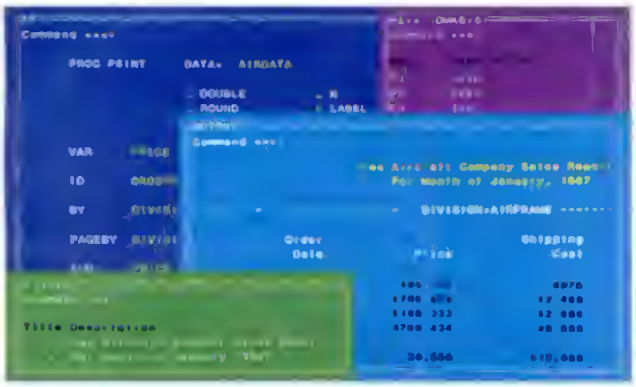

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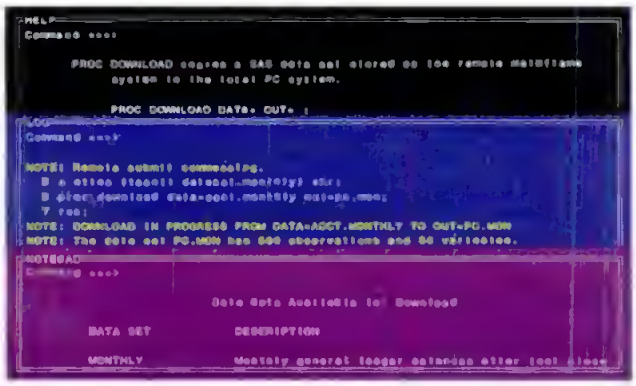

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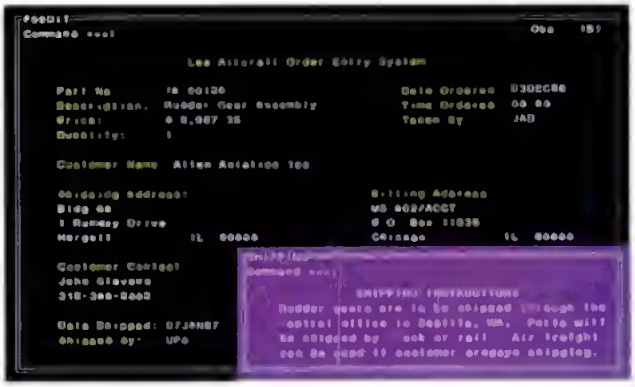

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Phone (919) 467-8000
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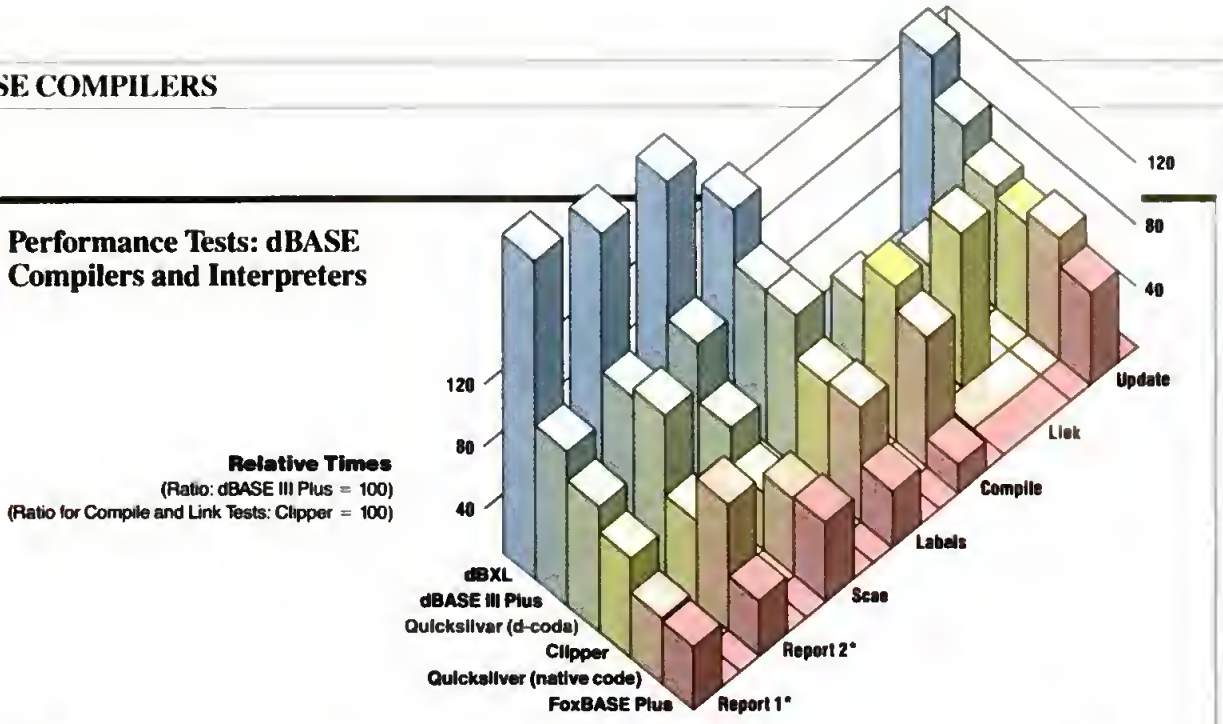
Performance Tests: dBASE Compilers and Interpreters



Performance Times (Times given in seconds)	Report 1*	Report 2*	Name Scan	Print Labels	Compile	Link	Index and Update
dBXL	249	501	474	73	N/A	N/A	444
dBASE III Plus	120	263	252	54	N/A	N/A	345
Quicksilver (d-code)	98	279	158	54	175	44	270
Clipper	78	142	96	39	232	71	245
Quicksilver (native code)	51	215	125	40	197	N/A	271
FoxBASE Plus	48	92	131	20	44	N/A	208

*PC Labs Project Database tests N/A—Not applicable: the compiler program does not perform these tasks as a separate function

dBASE Compilers and Interpreters: Test Methodology

Comparing several variants of compilers and interpreters to see how they work in the real world is a formidable task. Here's how we did it.

The large number of commands and functions, differences in operation, and other variations among the *dBASE* compilers and interpreters reviewed here make devising valid comparisons not only intimidating but downright difficult. Often such tests don't predict how an interpreter or a compiler will act in real-world programming situations.

Although execution speed is only one of several factors that you should consider in choosing a language implementation, it can be significant in many situations. Developers, in particular, care about how quickly large programs can be compiled and linked.

REAL-WORLD TESTS Programs doing useful work that is similar, or at least related, to what you might require in real life can serve as a valuable barometer of how each product operates. With that goal, we ran two groups of programs through each product. The first group consisted of two reports that access three data files containing personnel data such as salary history, department assignments, and the like for 500 employees. These reports are not particularly easy to program, but the source code files are short and easy to compile.

We also tested how each product would digest a commercial public relations contact management system. This program suite consisted of over 5,600 lines of *dBASE* code in 36 distinct program files. While some of the algorithms used in the suite are definitely on the tricky side, the actual coding techniques are straightforward. Being clever for its own sake often leads to code that is difficult to read and—worse—to maintain over time.

LARGE TEST FILE The data file for the commercial program contained 1,800 records and consumed nearly 700K bytes of disk space. Some languages can work very well with small files but are much less impressive when called on to manage larger pools of data, and our test file was sufficiently large to expose any such problems.

We first tested how long it takes to compile and link (if necessary) the entire program suite. (Of course, this test doesn't apply to the interpreters evaluated.) We then executed one of the program's maintenance options to reindex the main data file and update record number fields in all records. This test ensured that each version was working with appropriate indexes.

The program allows scanning through the data to locate records matching various company or individual name criteria. We tested how long it takes to find selected individuals near the end of the database. This test measures speed in moving through an indexed file and also string comparison speed.

Finally, we ran one of the program's label-printing routines. This module also selects a subset of the individuals from the data file according to arbitrarily complex search criteria that the program creates from user specifications. It also uses a pseudo-array scheme based on macro substitutions to manage four-across labels of varying length. The selection criteria chosen extracted 20 individuals from the 1,800-record data file.

NO SPECIAL FEATURES Except as noted in the evaluations of each product, we used the same code with all the products. We did not reprogram to take advantage of special features in a given language implementation, since this would have rendered our times noncomparable. For example, a couple of the products support true arrays—a technique that would probably optimize our label-printing routine.

We ran all tests on an 640K-byte IBM PC AT running at 10 MHz and equipped with a 10-MHz 80287. The programs and data resided on the 80-megabyte hard disk in an Iomega Bernoulli Box Plus. We installed no memory-resident utilities. The labels were printed with a Hewlett-Packard Laserjet Plus interfaced by means of a parallel port; given the small number of labels printed and the speed of the Laserjet Plus, the actual printing had little effect on execution time (and allowed us to make sure the routine operated correctly).

—Glenn Hart

gram, you open a sealed envelope and reinstall with another set of codes that allow uncrippled use.

When you start *FoxBASE Plus*, you are presented with a very *dBASE*-like interface, including the naked dot prompt. Fox Software is careful to call this an "interactive program development environment." This terminology is more than mere semantics, since *FoxBASE Plus* isn't an interpreter—it just feels like one. Unlike the *Clipper* and *Quicksilver* compilers, *FoxBASE Plus* has normal interactive *dBASE* commands like EDIT, BROWSE, DIR, and so forth that operate as they do in *dBASE*.

FEW EXTENSIONS *FoxBASE Plus* has few language extensions. The two primary new features are memory-variable arrays and multiple relations out of a database. Fox Software has also added minor enhancements to the interactive program editor, the BROWSE command, and a few other commands.

FoxBASE Plus specifies arrays through a new DIMENSION statement. You can create either one- or two-dimensional arrays, which are significantly more powerful and easier to program than *Clipper*'s single-dimension arrays. An array can store variables of any data type. You can even store different data types within an array, mixing logical, date, numeric, and string types with abandon (and without any error checking). This scheme is versatile, although it's the programmer's responsibility to keep track of what's happening. True arrays are both much faster and far easier to program than the macro pseudo-arrays that oldtimers have used to work around *dBASE*'s lack of arrays.

Multiple relations out of a database are equally potent. With the new ADDITIVE clause to SET RELATION, you can relate a master database to several other databases. As you move through the primary file, the record pointers in all the secondary files move in lockstep. This scheme lets you create complex interactions among data files with much less programming than would otherwise be required.

The current *FoxBASE Plus* release doesn't include an equivalent to *dBASE*'s ASSIST system. Experienced users or developers won't complain, but beginners will miss it. *FoxBASE Plus* doesn't yet support some of the new features added in *dBASE III Plus*, including View, Query, Catalog, and the screen painting system. And it doesn't import or export .DIF, .SYLK, and .WKS files. I haven't yet begun to use views, queries, and catalogs in my *dBASE* programming, but I've heard reports that a few third-party support packages that do employ these new features have to do some fancy footwork to work around the missing functions.

■ *FoxBASE Plus* gives you the benefits of interactive development and debugging plus speed and code protection.

BORN TO RUN Running programs under *FoxBASE Plus* is simple. You can execute existing *dBASE* code as is, with no compilation process. *FoxBASE Plus* loads each program module and compiles it on the fly. You can avoid the delay for compilation by precompiling your code modules, which *FoxBASE Plus* then loads as fast as it can read them from disk. Fox also supplies a binding utility that concatenates all your source code into one long text file that you can compile. In addition to loading more quickly, precompiled modules also execute faster.

FoxBASE Plus's index files are not compatible with those of *dBASE III Plus*. If you tell a program running in *FoxBASE Plus* to access a *dBASE* index file, it automatically creates a Fox index on the fly, using an extension of .IDX to differentiate it from a normal .NDX file. But if you want to access a database system under both *dBASE III Plus* and *FoxBASE Plus* (I'm not sure why you'd want to), changes made under *FoxBASE Plus* obviously won't be reflected in the .NDX files.

The network version of *FoxBASE Plus* is compatible with most of the syntax of the *dBASE III Plus* Administrator, so programs operating correctly with network *dBASE* will probably work correctly with multiuser *FoxBASE Plus*. Fox Software adds the ability to access files for reading only without locking the datafile, which should reduce contention in some situations.

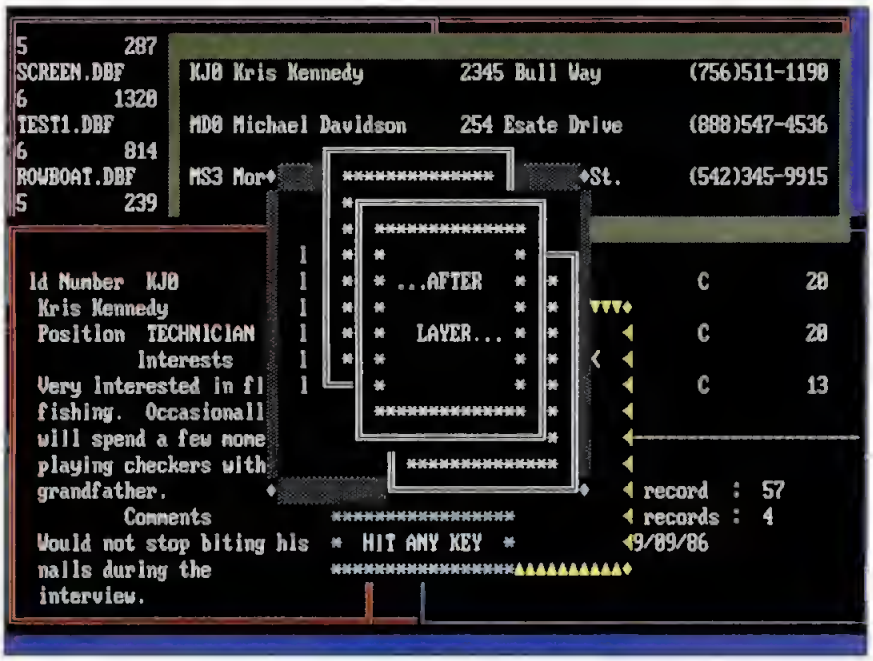
The company offers a run-time version of *FoxBASE Plus* that executes only precompiled code. Developers can buy a limited run-time version including ten distribution labels and buy more labels later, or purchase a royalty-free run-time package for about 60 percent more. This policy may deter some developers, since they can distribute applications programmed in the other compilers without any additional costs.

FoxBASE Plus's documentation is complete and reasonably well written. It's a bit on the Spartan side, but it covers all facets of the program's operation.

SPEED *FoxBASE Plus* has been widely heralded as the fastest *dBASE* language clone. It lived up to this billing on most but not all of our tests. Although *FoxBASE Plus* was faster than anything else tested on the PC Labs database programs and several of the list management tests too, *Clipper* beat it on one test and native-code *Quicksilver* on another—more examples of the fact that each program has certain routines that are fast and others that are less so. Based on these tests and our other experience with all the products, *FoxBASE Plus* is currently the speed champion of the *dBASE* language compilers.

The current version lacks some of the niceties that are particularly attractive to software developers. Fox Software's next release, Version 2.0, due sometime this summer, will include User Defined Functions, *Clipper*-like VALID and SAVE/RESTORE SCREEN, and a complete windowing system akin to that of *Quicksilver* and *dBXL*. It will require less memory, and the company claims it will also be much faster. Fox also plans to release a special 80386 version this summer using protected mode and capable of running under DOS 3.2.

In many ways, *FoxBASE Plus* gives you the best of both worlds: all the benefits of interactive development and debugging, plus the speed and code protection of a compiler. It's clearly a winner.



Quicksilver *has the ability to create some eye-popping windows that can be used to keep track of several files at once. There are eight windows in this example.*

Quicksilver

Quicksilver is a direct descendant of Wordtech Systems' first products, *dBASE II* and *dBASE III* compilers. These programs received something of a lukewarm reception compared with Nantucket's *Clipper*, primarily because of their slower execution times. They were pseudocompilers that converted source code to an intermediate form called d-code. The linker then created a run-time environment that executed the d-code. The end result was a freestanding .EXE file that you could run directly from DOS, but with limited processing speed.

Quicksilver's first stages in compiling code perform these same steps. You can stop at d-code if you wish, but most users will then call *Quicksilver*'s native-code optimizer into play. It translates the d-code into assembly code and then creates another freestanding executable program, which is significantly faster on most operations.

The only weakness in this procedure (other than the extra steps and time required) is the loss of automatic memory management. Since the d-code system automatically allocates memory, your applications require much less memory to run. As soon as you use the optimizer, the automatic memory scheme is disabled, and *Quicksilver*'s current release has no overlay system to let you control memory usage.

Quicksilver retains the earlier compilers' annoying trait of renaming files being processed by replacing either the first or the last character of the name with a special symbol. In essence, you must use seven-character filenames if you want to avoid any chance of strange results.

The program gives you extensive control over the various compilation and linkage steps by means of a long list of switches you can include in your commands. The syntax for these switches can be confusing. For example, the -f switch during d-code compilation and linkage indicates that you've decided to drop the first character of the filename instead of the last, but an -f switch during optimization conveys that you want speed optimized at the expense of program size.

COMPATIBILITY *Quicksilver* is reasonably compatible with *dBASE III Plus*, but, like other *dBASE* compilers, *Quicksilver* doesn't support some of the *dBASE* commands. More seriously, even the commands that the program does support contain several syntax differences that preclude running *dBASE* code without modifications. The SORT command, for example, is handicapped by the inability to mix ascending and descending keys, no FOR clause, and a nonstandard key specification syntax.

Quicksilver pioneered the excellent windowing system discussed at length in our review of Wordtech's *dBXL* interpreter. This wonderful enhancement can dramatically improve the appearance of your applications. *Quicksilver* also includes a User Defined Function system similar to *Clipper*'s, which allows you to add functions that you code to the language.

Quicksilver includes a superior symbolic debugger that gives you complete control over program execution and detailed information on what your program is doing at any time. The complex debugger requires time to learn how to use it to the fullest, but it's currently the best debugging tool that comes with a language. Once the syntaxes of *dBXL* and *Quicksilver* are brought into sync, many *Quicksilver* developers may use *dBXL* for initial development, which adds yet another useful tool for debugging.

NETWORK SUPPORT *Quicksilver* offers two types of network support. It gives you commands that are quite similar to the networking commands in *dBASE III Plus*,

PC MAGAZINE FACT FILE

Quicksilver
Wordtech Systems Inc.
P.O. Box 1747
Orinda, CA 94563
(415) 254-0900
List Price: $599; PC-DOS and MS-DOS libraries, $79.
Requires: 256K RAM, two disk drives, DOS 3.0 or later.
In Short: A compiler with a native-code optimizer that is significantly faster than earlier Wordtech compilers and offers some interesting and useful enhancements. Not copy protected

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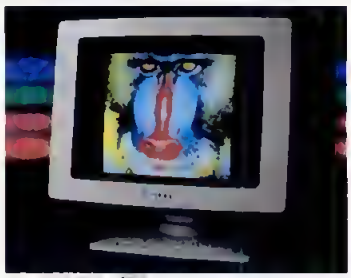

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Display
Band Width: 25 MHz,14" CRT
Mode 1: 64 colors, 720 x 350
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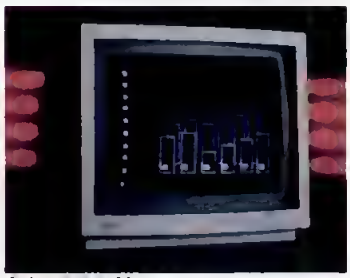

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Price Mfr's List: **$179**
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MULTI I/O CARD W/CABLES	**$56 EA.**
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which require you to modify your code extensively for multiuser operation. *Quicksilver* also includes an "automatic" mode that performs many of the housekeeping functions necessary in a complicated network environment and greatly reduces the amount of manual recoding. The LAN server software costs only $99, and only one copy is required per server, regardless of the number of workstations connected to the network.

We had to make several more modifications to the PC Labs Project Database reports and the commercial list management software to get them to compile successfully with *Quicksilver* than were needed for the other products we tested. Once the code was changed, *Quicksilver* compiled and linked smoothly.

SPEED Execution speed in the d-code form was generally somewhat faster than that of the *dBASE III Plus* interpreter but lagged behind the other compilers. The extra optimization step speeded up most of the tests rather significantly. The optimized applications were in the same ballpark as *Clipper*'s, and the *Quicksilver* code actually beat *Clipper* in one test and *FoxBASE Plus* in another. Overall, though, *Quicksilver* trailed *Clipper* slightly and *FoxBASE Plus* by much more in our test results.

It's clear to us that Wordtech's *dBXL* is more compatible with standard *dBASE* syntax, and *dBXL* offers some features that Wordtech has not yet incorporated into *Quicksilver*. The company tells us that, by the time this review appears, a new release of *Quicksilver* should be available that will add the new *dBXL* enhancements. Wordtech also plans to add overlay capabilities to optimized native code, speed up a few commands, and add the VALID clause pioneered by *Clipper* to improve input validation.

The current *Quicksilver* documentation is acceptable, incidentally, but not in the same league as *dBXL*'s, so hopefully Wordtech will upgrade the *Quicksilver* manuals as well.

Quicksilver is significantly faster than earlier Wordtech compilers and offers some interesting and useful enhancements. It's a viable choice now, although Wordtech will have to run hard just to stay in place in the speed and enhancement race.

Glenn Hart is a contributing editor of PC Magazine.

PC MAGAZINE EDITOR'S CHOICE

- **Clipper**
- **FoxBASE Plus**

All four programs reviewed here have merit—there's not a weak sister in the group. But two stand out as especially desirable for disparate segments of the dBASE *community.*

Clipper *is the best choice for the serious* dBASE *language software developer. The particular set of extensions and enhancements it offers the advanced programmer, especially the extremely powerful User Defined Function concept and VALID clause, save time, promote efficiency, and improve the final applications. The traditional compiler/linker mechanism allows linking of third-party and programmer-developed code modules.*

FoxBASE Plus *offers the comfort and debugging ease of an interpretive environment and the speed of compiled execution—in most real-world applications,* FoxBASE Plus *is the fastest* dBASE*-language system available. It's highly compatible with* dBASE III Plus*, just as easy to use, and less expensive.* FoxBASE Plus *is a perfect choice for those who need to access* dBASE*-type data files interactively.*

Serious developers can use it too, although it doesn't offer as full a range of extensions as Clipper.

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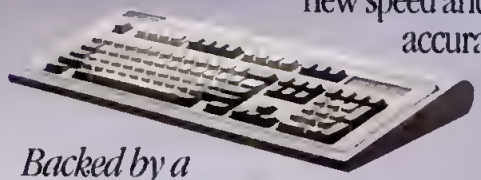

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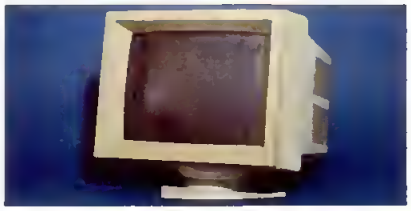

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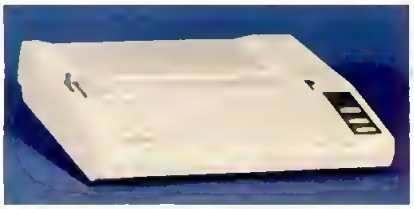

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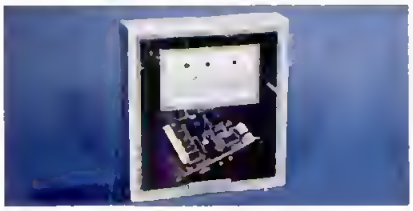

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What's more, depending on the software, the 410 can display up to 132 columns by 25 lines of text, giving you increased spreadsheet capability. Plus, you can choose a green, amber or white CRT—whichever is most pleasing to your eyes. A non-glare nylon mesh screen adds to easy-viewing, high-contrast display. And the attractive cabinet styling is aesthetically compatible with the IBM PC—and will actually complement any office setting. In addition, the unusually small footprint saves valuable desk space.

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CIRCLE 102 ON READER SERVICE CARD

On with the Show

Are you still trying to figure out how to make an effective PC presentation without huddling the Board of Directors around your computer? LCD imaging systems from Kodak and Health Telematics Systems will project your PC's displays onto any available wall.

Remember when you were a kid and needed cash to buy a bike or run away to Borneo? One way to your financial goal was putting on a show—converting the old barn in the backyard to a stage, immersing yourself in improvised clothes and Mom's makeup, then performing in front of a willing and paying audience that traveled from all corners of the countryside to your neighborhood. At least that's how things worked when you inhabited the silver screen, and reality was a thing called Hollywood.

Today, when you need cash, your last resort is a thing called work, and part of the job is putting on a show, now laughingly called a business presentation. The venue is boardroom not barn, the clothes fit a little better (they should, for the prices you pay), and the audience starts off unwilling and bored then heads downhill.

Should you ever get stuck making one of these presentations, you probably will wish you had made it to Borneo. At best you've got visual aids, so you can hide in the dark as you show the stack of slides, made with *1-2-3* graphics on your PC, that the photolab decided to wrinkle and the gods of probability decreed would appear upside down or backwards. Worse, six of them have somehow disappeared (the ones that show the business turn-around), the snoring has begun to drown out your wavering voice, and the boss's fingers have turned into a metronome.

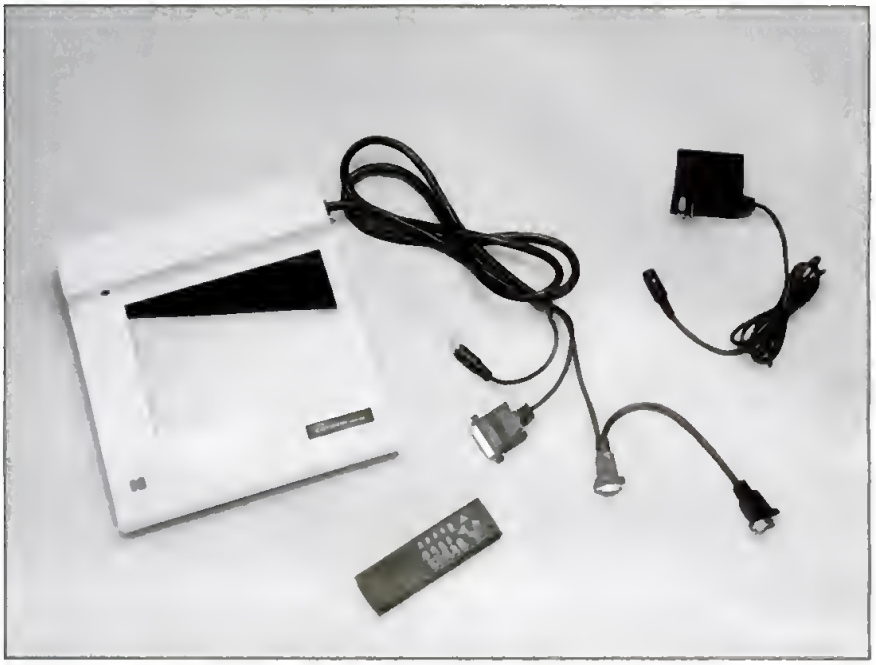
If anything can bail you out of like disasters, it's animation. Put your PC to work generating moving, active images—charts that stack themselves to make your point, displays that move

and chase around the screen—using programs like *PC Storyboard*, *Show Partner*, or *VCN Concorde*. The only problem is that then you're stuck gathering everyone around a tiny monitor display. The primary alternative—a projection television screen—is expensive (prices start at about $3,000 and multiply by ten for boardroom quality). It's also difficult to move and set up, and unlikely to be found everywhere you take your show.

Enter the Kodak Datashow System and the Health Telematics Systems Davis Transview. Using either system, you can turn your PC and any garden-variety overhead transparency projector into a complete presentation system that will put animation and any other image your PC can generate in front of your audience. Make that PC a laptop, and you can take your show just about anywhere because you're nearly guaranteed that every boardroom or even motel conference facility will have at least one overhead projector.

Setting up such a show is even easier than painting an ear-to-ear smile on your face with Mom's lipstick: just plug in the Datashow or Transview, then focus the projector. The whole show—all the blocking and cues—can be handled automatically by someone who doesn't suffer from stagefright: your PC.

Actually little more than extensions of your PC's display system, these technological marvels work simply by duplicating the images that appear on your PC's monitor onto thin, flat screens that fit atop the flatbed of an overhead projector. They make their images using liquid crystal displays—the same sort of LCDs used in laptop computers and digital watches.



The Kodak Datashow system consists of the LCD imaging screen (left), with its 6-foot cable ending in a spread of connectors: a male DB-9 connector, a female DB-9 connector, and a DB-25 plug. Also included are a 20-button remote control device and an AC power supply.

Unlike the dismal images you've become accustomed to with laptop computers (even with supertwist and all the new technologies), these projected LCD images put on a bright showing. They're really readable, and their larger-than-life size on the silver screen adds impact, even though they hark back to Hollywood's heyday and stubbornly insist on the purity of black and white—actually a toned monochrome of dark blue on light.

Both of these display devices are compact, so you can tote one along with your laptop wherever business beckons. Best of all, they cost only one-third to one-half the ticket of an entry-level projection television monitor.

PUSH THE BUTTON The better known of this pair of products undoubtedly is Datashow, known in some parts as "Sayette" after Sayette Technology, the organization that originally developed and now manufactures it. Formerly an independent company, Sayette is now a division of Eastman Technology, which is part of the Eastman Kodak Company.

More than a mere display, Datashow is a complete system that includes the image-making hardware itself, a power supply, a remote control unit, and software. You get everything in one box, an elaboration on George Eastman's original camera-making philosophy: You pay your money and we do the rest. (Kodak also sells the display without the software and remote control features.)

Datashow works with a standard CGA or EGA video board. With the latter, only the CGA mode can be used, however. Datashow plugs in like any other display with a simple DB-9 connector, but provides an extra jack into which you can plug your regular graphics monitor for a simultaneous small-screen display.

The Datashow unit comes in a businesslike beige plastic case that's about 12 by 13 inches wide and a little more than an inch high. Its electronics reside under a long, narrow plateau that rises an additional inch along the front. Near the middle is a flat glass window measuring 8 by 6 inches—a light gray when not operating—on which the image appears.

PC MAGAZINE FACT FILE

Datashow System
Eastman Kodak Co.
Dept. 620
Rochester, NY 14650
(800) 445-6325
List Price: $1,270 (complete system); $1,095 (without software or remote control).
Requires: CGA or EGA; software requires 128K RAM, DOS 2.0 or later.
In Short: An LCD imaging system for use with overhead projectors that gives 640 by 200 monochrome text and graphics images. Includes remote control and slide show software.

CIRCLE 683 ON READER SERVICE CARD

Photographs: Thom O'Connor

Unlike the Datashow, the Davis Transview, marketed by Health Telematics Systems, is controlled by a full-length, XT-height expansion board. It is a cleaner system, with fewer parts, but is less useful for on-the-road presentations since most portable PCs can't accommodate the board.

The whole thing rests on four hard plastic protuberances and is designed to sit on the fresnel stage of an overhead transparency projector. Between the rear pair of feet runs a bent metal bar, in places layered with rubber, that allows you to raise one end of Datashow by about a quarter-inch. According to Kodak, giving a lift to one end of the device may make its image more evenly focused when using some styles of overhead projectors.

Other than a couple of logos and a tiny air hole in the electronics ridge, no other features appear present on the device. Its only appendage is a single, rather thick (nearly one-third of an inch in diameter) cable that trails 6 feet out from the raised electronics section like a muskrat's tail, ending in a spread of connectors—one female DB-25, a male DB-9, a female DB-9, and a DIN plug.

Two of these connections are mandatory: the male DB-9 must mate with a CGA-style video output, and the DIN plug couples with the output of a wall-mounted power supply transformer to juice up the system. The female DB-9 allows you to daisy-chain another display device, and the DB-25 plugs into a serial port to give life to Datashow's advanced features.

Make the necessary link-ups, and Datashow comes quietly to life—with none of the horizontal sync squeal of an ordinary RGB display. Text pops up on the Datashow panel as if shown on a conventional monitor, but faintly. If you look directly at the Datashow screen you'll have to squint to make out characters. Unlike the LCD displays that come built into laptop computers, you'll find no contrast or viewing angle adjustment on Datashow.

INVISIBLE LIGHT That's where the remote control comes in. About the size and shape of a pen-and-pencil box set (about ¾ by 1¾ by 6 inches), the black plastic control panel boasts 20 tiny gray rubber keys labeled with the numerals zero through nine, an asterisk, the letter N, Menu, Sel, and four cursor arrows. A red LED in the upper-right-hand corner confirms when to press one of the buttons.

The wireless control derives its power from two AA batteries (which seem to contribute most of its weight) and signals Datashow with a beam of infrared light. Datashow detects these invisible signals through that small air hole in its electronics bay: the hole has an infrared-sensitive photodetector hidden at its bottom.

Various combinations of button presses control the look of Datashow's display. In general, all commands are prefaced by a press of the asterisk. For instance, an asterisk then a press of zero clears the screen. Later, pressing the N key restores the image—the one currently generated by the host computer, not the one that was cleared. Datashow has no memory of its own to store images.

Other key combinations will switch the active area of the Datashow screen to reverse video and pan the image left or right, up, down, or across the screen so that you can center the display. Still others change the screen contrast and give a focus-like effect by increasing the weight of the character font. One additional combination allows you to adjust the number of pixels in the display lines.

The rest of the remote control functions operate through the *Showmaker* software and RS-232 connection.

Showmaker is derived from the Brightbill-Roberts/The Marketing Channel and Co. program, *Show Partner*. It has several modules: one captures screen images onto disk files for later display; another allows you to arrange those screens into presentations, specifying fades, dissolves, and wipes to step between them; and a third actually shows those screens to the audience in the manner dictated during preparation. Missing from the *Show Partner* modules, however, is a full-fledged screen editor for modifying individual images.

Added to the basic software are remote

PC MAGAZINE FACT FILE

Davis Transview
Health Telematics Systems Inc.
1900 Dublin-Granville Rd.
Columbus, OH 43229
(614) 267-8100
List Price: $1,350
In Short: An LCD imaging panel and PC adapter board for use with overhead projectors that gives 640 by 200 monochrome text and graphics images with the slightly squashed 3:2 aspect ratio.

CIRCLE 692 ON READER SERVICE CARD

control provisions. When using the *Showmaker* presentation or editing module, Datashow's infrared remote control can flip forward or backward in the slide show presentation, generate and move an on-screen pointer, or show image-identifying information to help in editing (in addition to its other functions, of course).

PLAIN IMAGE The resolution of Datashow follows the CGA standard. It's 640 by 200 pixels, which means that lines not parallel to an edge of the screen are decidedly jagged. The character font is roughly the same as is shown on any other CGA display; each letter is formed in an 8- by 8-dot matrix that rates as legible, but little more.

The aspect ratio of the screen is a perfect 4:3, exactly what a standard IBM CGA display aspires to. Consequently, graphics images should have their desired natural shape: circles will appear as circles rather than ellipses.

The on-screen image is monochrome only, with but one selection of brightness level: individual pixels are either on or off. Color mapping is arbitrarily set; hence the video colors black, blue, red, and magenta appear on Datashow as clear, while green, cyan, brown, and white appear opaque (well, darker). Highlighting has no effect on color mapping—red and pink look identical when printed on Datashow. Reverse video interchanges the clear colors with the opaque, but not the mapping itself.

Datashow's clear colors actually project as pale blue; opaques as a darker blue. Although the contrast ratio hardly rates as fantastic (about three-to-one when measured with a light meter), the color distinction is clear and the projected image is very readable.

The top of the Datashow display panel is covered with glass, so you can place other transparent materials on it without worrying about scratches. The bottom is a softer, heat-absorbing plastic that can be scratched relatively easily. Because the top is not protected against the heat of the projector bulb, Kodak does not recommend operating the device upside down. Its very shape discourages such use, however.

The instructions that come with Datashow are hardly formidable—just a 24-page pamphlet. Most important is the listing of remote control functions. Otherwise, Datashow operates like a video display. You should need neither training nor a Mensa-level I.Q. to figure it out. *Showmaker* is covered in an equally elementary 48 pages.

SCANDANAVIAN IMPORT From the land of the fjords comes Datashow's only major competition, Davis Transview. Designed with the same purpose in mind—making PC video wall-size with the help of an overhead transparency projector—the Norwegian product reveals some divergent design philosophies.

Transview is essentially a large beige plastic pad (1 by 14 by 10 inches) with a 9 by 6 display window near its center. The left 3 inches of the pad are devoted to its electronics endowment, capped by a slight quarter-inch rise from which a tiny fan peeks out.

■ Once the screen is lit, Datashow will give you more freedom during your presentation.

On the left edge of Transview are a female DB-25 connector and its sole user control, a contrast thumbwheel.

Unlike Datashow, Transview uses its own host adapter board, which also supplies the display with power. The display and adapter connect with a single cable about 2 meters long.

The host adapter is a full-length (13½-inch) expansion board that is XT-height and uses the 8-bit, XT data bus. Its circuitry consists almost entirely of an overabundance of simple TTL (transistor-to-transistor logic) chips.

One bank of four DIP switches allows configuring Transview to match most systems. One switch adjusts for CPU speed, switchable between high and low. Two others set Transview for either master or slave operation (with Master the host has no other video adapter; with Slave, Transview operates with the existing adapter) and set the host display to monochrome or color. A fourth switch determines whether the IBM or a special Transview character set will be used.

The special character set differs from IBM's only by a few high-bit characters. For the most part, even block graphics have the same look, notwithstanding the chosen set.

A toggle switch on the retaining bracket of the adapter board flips the display between normal and reverse video modes.

Set the switches, slide in the board, connect the cable, and Transview is ready to run. You might not even need instructions to get everything ready, which is good because Transview comes without a manual. Your only help is a user's guide: a single plastic laminated sheet about the size of a placemat that quickly outlines installation and operation.

Its on-screen resolution is the same as an IBM CGA system—640 by 200 pixels—and each character is displayed in roughly the same 8- by 8-dot matrix. The 3:2 aspect ratio of the display definitely is elongated to the horizontal compared to the nominal 4:3 look of the IBM system. Consequently in graphics modes what should be squared is rectangular, and circles take on a decidedly ovoid cast.

Like Datashow, Transview is a monochrome-only machine. The background color of the on-screen image is yellowish; characters or graphics appear grayish/greenish blue.

Transview translates colors into monochrome in an interesting manner. Its total palette is but two colors—near clear and opaque. Normally only black and dark gray translate as clear; other colors become opaque. But put red text on a green background—or any color on another color other than black/dark gray—and Transview comes up reverse video.

More interesting is its handling of highlighted characters. Normal text characters are made from a double-width of Transview's vertically elongated pixels. Highlighted characters get a triple shot of pixels, giving them a bolder look.

As with Datashow, transparencies may be laid atop Transview. You can even put a clear acetate on it to add your own drawing to the computer display; however, never

write directly on the Transview screen.

The small fan actively cools Transview's LCD. Note that the fan, as with the rest of the Transview system, receives its power from the host PC. When the PC is off, the fan does not operate. If the overhead projector remains on while the PC is off, the LCD of Transview may get overheated, possibly damaging it.

PORTABLE PICK Transview is compelling because it appears a cleaner system—fewer parts and simpler cabling. However, Datashow has important advantages when you're on the road.

Datashow requires no special adapter because it runs from a CGA port. If you plan on traveling and using a laptop to sell your snake oil, making do with an ordinary CGA output can be a lifesaver. Most laptops have no provision for PC-size expansion boards, such as Transview requires, but do allow for a normal CGA output. Datashow makes the perfect companion for almost any such laptop. Transview must stay tethered to a desktop PC.

Yet the single cable approach of Transview may be preferable when used in a community room rented out (or assigned to different corporate departments) for presentations. Transview's mechanism can be safely locked up between uses and requires only a simple plug-in when needed.

On the other hand, once the screen is lit, Datashow will give you more freedom during your presentation. You can move the screen image, adjust its intensity or focus from almost anywhere in the room as you go along using its remote control. You can interact with the software or even switch off the screen—a precaution that lets you avoid a display of both the system boot-up and of calling your presentation from DOS. Also, Datashow's graphics have a more natural look because of the program's aspect ratio.

The choice between these two amounts to your preference in details. Either will change your PC from presentation preparer to presentation medium. Either will let you add the extra punch of animation to your talks. And either may help make you a corporate presentation star. PC

Winn L. Rosch is a contributing editor of PC Magazine.

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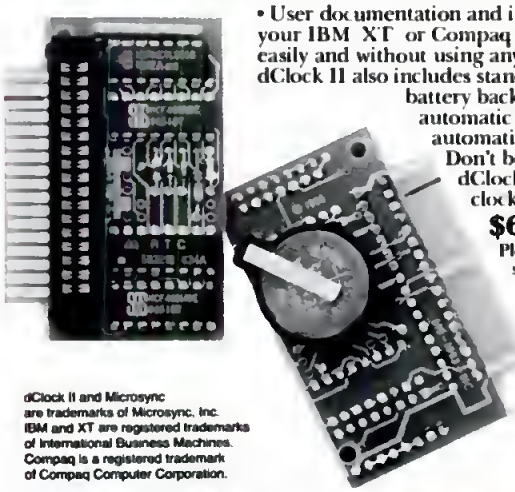

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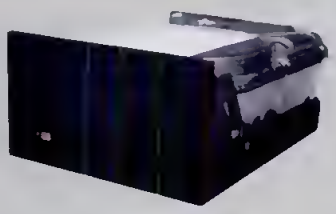

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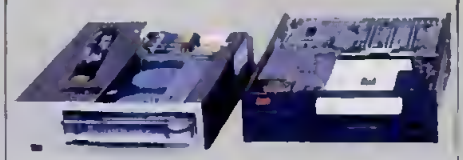

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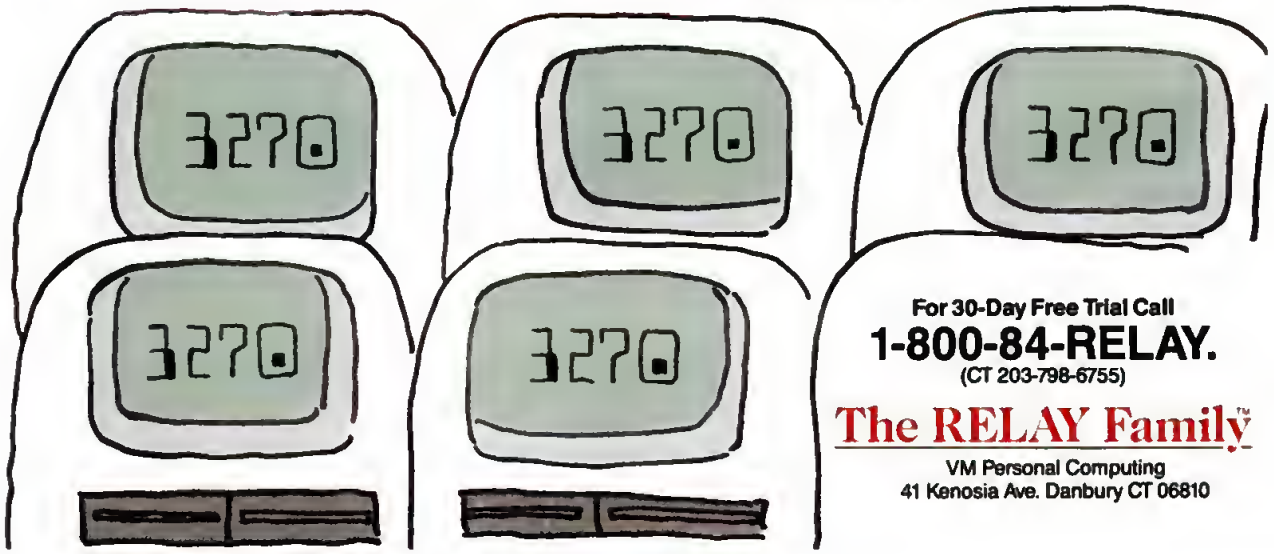

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MAKING CONNECTIONS

Data PBXs

Some simple software, a small box with a microprocessor, and some wiring may be the low-cost solution to your networking needs—and the answer to how to integrate the new IBM Personal System/2 into your network. The only problem is installing the RS-232C cable.

FRANK J. DERFLER, JR.

PC users who need to transfer files and share equipment are finding an inexpensive, easy alternative in the data Private Branch Exchange (PBX). They're using this type of circuit-switched system to enable their Apple Macintosh computers, for example, to exchange files with Wang PCs, and their dumb terminals to share printers with IBM PCs and Toshiba laptops—all on the same network.

Integrating new systems like the new IBM Personal System/2 machines highlighted in this issue is simple with a data PBX. It's just a matter of attaching a cable to the machines' RS-232C ports and running some simple software.

In this article we examine the data PBX as a connectivity alternative and review three products that are typical of the market: Avatar Technologies' Alliance ZSL System, Digital Products' NetCommander, and Newbridge Networks' 1008MainStreet Data Controller. In upcoming issues we'll look at other types of circuit-switched systems.

CIRCUIT-SWITCHED Data PBXs, like digital PBXs, Centrex systems, and RS-232C patch boxes, are essentially circuit switches that switch connections among various devices on and off. Specifically, data PBXs use a switching system housed in a small box containing a microprocessor. RS-232C cables connect the networked devices through their RS-232C ports. And each microcomputer attached to the switch uses communications software that moves data in and out of the serial port.

Whereas the better-known media-sharing networks for personal computers, such as 3Com's Ethernet, IBM's Token-Ring Network, or AT&T's StarLAN, attach network stations permanently to a common wiring scheme and use sophisticated protocols to share the wire, circuit-switched systems work like a voice telephone operator. They connect stations when a user asks to transfer information or share a common device, and they break the connection when the activity has been completed.

Circuit-switched systems fall into two broad categories: those that use a matrix device to logically "hard wire" two ports together and those that use a connection through a data path. Matrix-connected systems pass anything they get in one port out the other port without change. The users at both ends have to worry about setting proper bit-per-second rates and other factors. Switches that work under the data path concept can work on the data and adjust the speed, parity, and other factors to match the settings of each port.

Neither method is clearly superior to the other in all applications. They reflect different philosophies about placement of the processing power and about system responsibilities.

The three products reviewed here all use the data path concept. (For more information about other circuit-switched devices, see "An Overview of Networking Options," *PC Magazine*, Volume 5 Number 21.)

USES You can use a data PBX effectively for exchanging files among different types of PCs; sharing printers, plotters, modems, and other equipment; using electronic mail, group calendar, and other productivity programs; and entering mini/mainframe host computer systems.

With a data PBX, a PC user can receive an ASCII text file from a Macintosh, edit it, and then retransmit the file to a remote printer. If the printer is busy, the PC user can elect to queue on the printer's port until it is free. Anyone with access to the network, even those with simple terminals, can connect to host PCs running electronic mail programs, or even gateways to mainframe computers, and receive fast service.

Although the products we review here are appropriate mainly for small PC-based work groups, you can cascade them to service vozens of PCs or use larger switching systems to service over 1,000 connected devices.

MAKING CONNECTIONS Physically, a data PBX appropriate for a work group of 6 to 12 people is usually a flat box a little smaller than a briefcase, with connectors on one or more sides. Electronically, it usually has a microprocessor in the Z-80 or 8080 class, with software in ROM that monitors a group of RS-232C ports and connects ports together in pairs.

A data PBX can connect to a host computer in one of three ways. If the host has serial RS-232C communications ports (as DEC VAX systems do), you can simply connect it to one port on the data PBX. If the host uses a unique communications scheme like IBM's 3270 SNA, then the data PBX can connect PCs to a standalone device called a protocol converter, which converts between the ASCII asynchronous data stream of the PC and the EBCDIC synchronous data flow of the IBM system. Finally, a data PBX can connect PCs needing terminal service to one PC acting as a gateway, using the same types of multisession gateway software and hardware that media-sharing LANs use. You can use the EasyLAN zero-slot LAN communications in this role because EasyLAN has the same NETBIOS interface that Novell, IBM, and 3Com networking software use.

■ Data PBX systems offer an efficient and low-cost way to transfer data and share equipment in work groups of 3 to 1,300 nodes.

The only requirements for the stations connected to the ports is that they be able to transmit and receive on an RS-232C line. They don't need any processing power beyond what is necessary for responding to RS-232C signals. Printers, modems, screen cameras, plotters, minicomputers, so-called dumb terminals, and any other sort of RS-232C devices can be a network node. Similarly, PC-compatible laptops without expansion slots and other machines that are only software compatible, such as the Wang PC, can be equal partners on a network with PCs, ATs, and Personal System/2 computers.

Some products, like NetCommander, can hold and buffer files to be printed so the user requesting the connection can quickly download a print file and move on to other work. The processor in an intelligent system of this kind normally monitors the data stream to detect the end of the print job or to receive other commands. Processors that monitor the data stream sometimes limit or even react to data coming through their ports, even when the characters aren't addressed directly to them.

COST Even with workstation groups as small as five or six stations, a data PBX system can cost as little as $100 per port. The wiring is an extra cost, but the eight-wire cable that these systems typically use costs a little less than coaxial cable and is easy to install. If you consider the cost of software, servers, and other factors associated with a media-shared LAN, even the lowest-priced StarLAN system costs over $400 per port.

THE DOWNSIDE On the downside, data PBXs can be difficult to set up, slow to transfer large files, and uninformative about systems operations. And one of the tasks circuit-switched systems can't do extremely well is to give several stations simultaneous access to the same set of data files. Multiuser database management work is best done through a media-shared LAN with a sophisticated multitasking and multiuser operating system.

The wide variety of connectors, jumpers, and other alternatives available in the RS-232C wiring system makes getting everything working right the first time a matter of pure luck or at least of scrupulous adherence to the instructions. During our tests we made some connections that would let us communicate from keyboard to keyboard, but they froze when we tried

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to transfer a file. Incorrect cable connections were to blame.

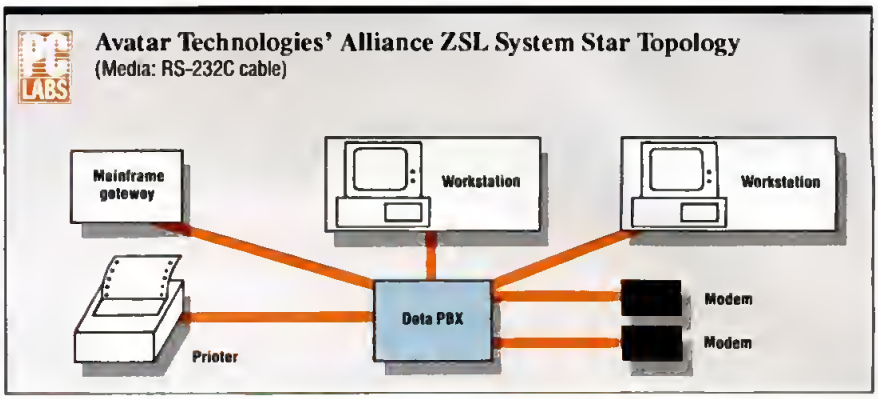
New RS-232C wiring alternatives such as flat RJ-45 cable and connectors (a slightly larger version of the RJ-11 telephone connector) make installing wiring easier. You can click the cables together just like telephone wires, reducing some of the frustration of using RS-232C wiring.

RS-232C wiring is inherently short-range wiring. In its typical form, only wire runs of less than 150 feet can operate at high speeds. Runs of 500 feet are practical, but with reduced speeds. You can extend this distance several ways, but you'll add cost and reduce throughput in the process.

The RS-232C wiring standard is slow at best and cantankerous at worst. Data PBXs generally move data at 19,200 bps, so while your screen will fill up very fast for electronic mail, transferring a large file takes a considerable period of time.

Data PBX systems generally have poor diagnostic and operational indicators. Most indicate if the power is on and little else. No signal lights show activity on a port or indicate a good connection. Data PBX software can display a chart showing the active connections to some terminals, but two of the three systems we evaluated don't indicate activity or system loading (the exception, Avatar's Alliance ZSL, includes software that creates log files of all activity).

LOW-COST EFFICIENCY Data PBX systems offer an efficient, low-cost way to transfer data and share equipment in work groups ranging in size from 3 to 1,300 nodes. In many installations, these circuit-switched systems already offer all the LAN connectivity that the users will ever need. Before you select a more expensive media-sharing LAN, you should consider using a data PBX.



The Alliance ZSL System is unique in its expandability; you can purchase 6-port expansion boards for the 8- and 12-port systems to move them up to 20 ports. The Alliance ZSL uses DB-25 jacks and 8-conductor wiring to connect the equipment to the switch. The system uses a Hitachi 64180 CPU to monitor the ports. The power of (1) the Alliance ZSL System comes from the synergy of its ROM-based program and (2) the software running in the PCs. Also shown in the photograph below is (3) the system power supply and (4) a serial-to-digital converter.

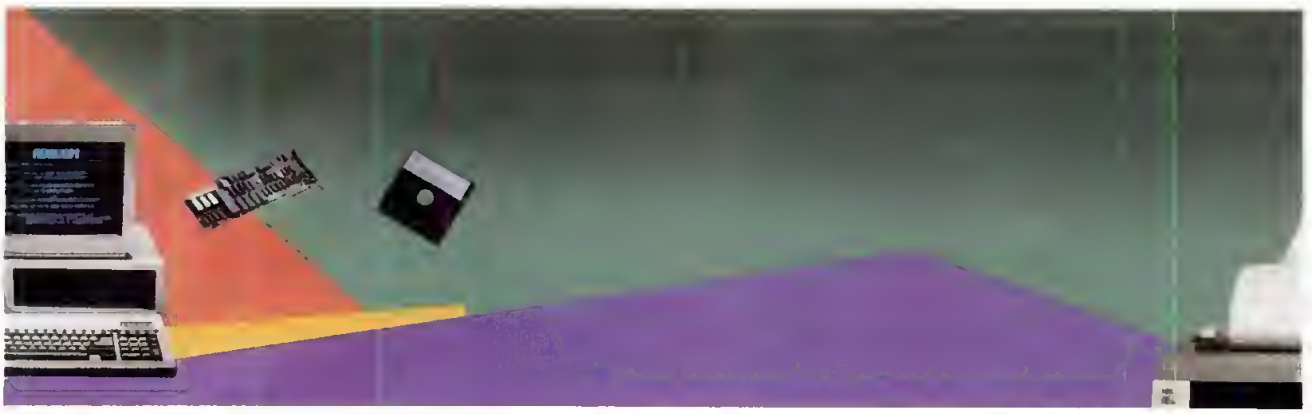
AVATAR TECHNOLOGIES INC.

Alliance ZSL System

Avatar Technologies manufactures and markets several types of communications products, including protocol converters that can connect inexpensive terminals to computers using communications protocols such as IBM's 3270 SNA. The Alliance ZSL System is a data PBX switch and software combination that allows you to share attached devices such as printers, and to exchange data among computers attached to the ports.

The Alliance ZSL is tightly integrated between the circuit switch hardware and the software run in PCs attached to the switch. The system can also connect non–IBM PC standard devices, like Apple Macintosh computers, to printers and other devices attached to the switch.

The Alliance ZSL System is relatively small, like the other two devices reviewed here. It is unique, however, in its expandability. When you purchase an Alliance ZSL, you can specify a model with 8, 14, or 20 ports. Later, as your system grows, you can purchase 6-port expansion boards for the 8- and the 14-port systems, to move them up to 20 ports. Expanding the capabilities of the system is as easy as putting an expansion board in a PC. We tested the



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Data PBXs: Summary of Features

(Products listed in ascending price order)

The features of any network system are largely determined by the software. However, with the data PBX systems reviewed here, high ratings are equally split between software and hardware capabilities. For instance, NetCommander scores well on print spooling because it contains the necessary memory chips to store print jobs internally without relying on the RAM in the PC. Software comes into play with other features; the Alliance ZSL System rates well on modem pooling because of its ability to select alternative devices if one is busy.

The Alliance ZSL stands out in several categories: it has an excellent menu structure, is the only product of the three that reports on activity (in the form of a log file), and is the only product of the three that can force peer-to-peer messages to the screen.

	1008 MainStreet Data Controller Newbridge Networks Inc.	Alliance ZSL System (8-port) Avatar Technologies Inc	NetCommander (16/256) Digital Products Inc
List price	$1,099	$1,195	$2,695
INSTALLATION			
Ease of installation	■■■	■■■■	■■
Documentation	■■	■■■■	■■■■
NETWORK ADMINISTRATION			
Security	■■■■	■■■	■■■
FEATURES			
Activity reporting	N/A	■■■	N/A
Print job spooling	■	■■■■	■■■■
Modem pooling	■■■	■■■■	■■■■
Peer-to-peer communications	N/A	■■■■	N/A
Ease of use	■■	■■■■	■■
Speed mediation	■■	■■■■	■■■■

—Indicates Editor's Choice.
*N/A—Not applicable: does not perform this function.

Excellent — ■■■■ Good — ■■■ Fair — ■■ Poor — ■

Alliance ZSL 8-port system.

Two lights are visible on the Alliance ZSL System. One shows that the power is on, the other that the processor is active. The processor activity light, however, doesn't indicate anything about the level of activity on the network.

The Alliance ZSL uses RJ-45 jacks and eight-conductor wiring to connect the equipment to the switch. The jacks keep the size of the unit small and simplify the wiring somewhat. Avatar supplies DB-25 to RJ-45 adapters for regular PCs and 9-pin DIN to RJ-45 adapters for AT-type computers. These adapters simplify the DTE/DCE wiring questions and eliminate connector problems at the switch end.

CAPABILITIES The power of the Alliance ZSL System relies on the synergy of its ROM-based program and the software running in the PCs. More so than the other systems we tested, the Alliance ZSL is a data PBX designed to work with IBM PC standard systems.

The Alliance ZSL does an excellent job of file transfer and a good job of printer sharing. Its modem-sharing capabilities require some user adjustment of the speed of incoming calls, but the use of modems for outbound calls is enhanced by a "rotary hunt" technique that finds the next available similar device if the one you called is busy.

The Alliance ZSL PC software resides in the background memory of every active PC on the network. Requiring about 150K bytes of RAM, it handles print spooling and file queuing in the PC's memory. The software is menu driven, and the menu pops onto the screen when you strike the Alt-Spacebar combination.

The software gives PC users connected to the data PBX a wide range of capabilities. They can send files to and receive files from each other, send messages to each other, and read and post messages on an electronic bulletin board. File transfers don't interrupt the work of the PC at the other end. Rude messaging is available; when you receive a message from another

EDITOR'S CHOICE

FACT FILE

Alliance ZSL System
Avatar Technologies Inc.
99 South St.
Hopkinton, MA 01748
(617) 435-6872
List Price: Alliance ZSL 8-port system, including Alliance ZSL networking software, 4 20-foot cables, 3 PC/Printer connectors, 1 modem connector, $1,195. Alliance ZSL 14-port system, including Alliance ZSL networking software, 4 20-foot cables, 3 PC/Printer connectors, 1 modem connector, $1,595. Alliance ZSL 20-port system, including Alliance ZSL networking software, 4 20-foot cables, 3 PC/Printer connectors, 1 modem connector, $1,995. 6-port Expansion Module, $600; Parallel Printer Adapter, $150.
Software: Alliance ZSL: included in system; requires 128K RAM, DOS 2.0 or later; not copy protected.
In Short: An easy-to-install data PBX switch and software combination, the Alliance ZSL System is tightly integrated between the circuit switch hardware and the software run in PCs attached to the switch, yet it can connect non–IBM PC standard devices. It offers the ability to expand the number of ports.

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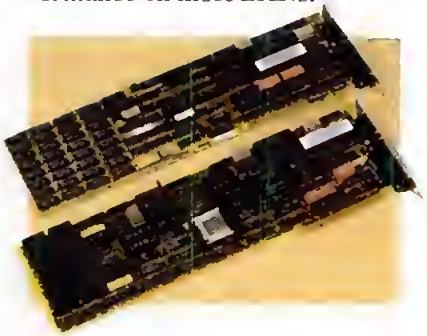

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Computer Products

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Alloy Computer Products, Inc., 100 Pennsylvania Avenue, Framingham, Massachusetts 01701. (617) 875-6100, TWX: 710-346-0394

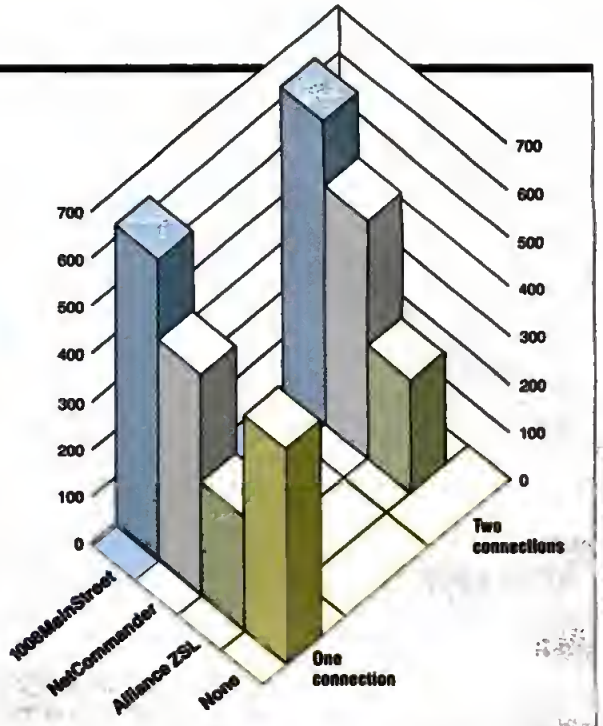
Alloy Computer Products, Inc., 9 Executive Circle, Suite 240, Irvine, California 92714. (714) 261-7661

Performance Tests: Data PBXs

Performance Times
(Times given in seconds)

System	Software	File Transfer: One connection	File Transfer: Two connectionn
1008MainStreet Data Controller	*EasyStreet*	629	630
NetCommander (16/250)	*EasyLAN*	461	498
Alliance ZSL System (8-port)	*Alliance ZSL*	237	237
None	*EasyLAN*	454	N/A

N/A—Not applicable



The spectacular performance of the Alliance ZSL comes from its use of high-speed ports built into the switch—115,200 bits per second for an AT, 76,800 bps for a standard PC. The switch mediates differences between the transmission rates of the connected devices. Data PBXs from other manufacturers don't mediate these high speeds.

The 1008MainStreet Data Controller should have gained a small advantage in this test. Because it does not allow the use of wildcard file transfers, all of the data contained in 12 discrete test files had to be combined into one file of over 360K bytes. The time taken by DOS to examine the file allocation table, find the next matching file, and begin the transfer is eliminated in the 1008MainStreet results. While this would be significant in the much faster media-sharing LANs, the amount of time in question is a small percentage of the total transfer time in these tests. However, even with this unfair advantage the 1008MainStreet comes in as the slowest of the three products because we could not get the switch to sustain such a large file transfer at any speed faster than 9,600 bps.

in PBX systems, unlike media-sharing or zero-slot LANs, the speed of the connection is dictated by the switch rather than by the load on the shared CPU in the server. As a result, we designed tests for the speed of the switch.

We ran the **File Transfer** performance tests using an 8-MHz IBM PC *AT* as a server and three standard IBM PCs. The test consists of transferring 12 files of various sizes (totaling over 360K bytes) from a RAMdisk on the *AT* to a RAMdisk on the PC through the data PBX. The bit-per-second rate selected for the transfer is the highest one recommended by the manufacturer or allowed by the software.

In order to test the loading effect on the switch, we ran this test twice. The first result indicates file transfer times from the *AT* to the PC with no other PCs active on the network. The second test result shows the effect on the timed portion of the test when two other standard PCs simultaneously access the switch and attempt to transfer a constant stream of data at 19,200 bps.

Since these systems are likely to be used with their recommended or provided software, we decided to show you how fast they complete the performance tests using the programs recommended for each product. For comparison, we have included the time for the same file transfer using *EasyLAN* operating at 19,200 bps with a direct RS-232C cable between the systems. The EasyLAN system was our Editor's Choice in last issue's review of zero-slot LANs ("Making Connections: Zero-Slot LANs," *PC Magazine*, Volume 6 Number 12), and this comparison gives a relative indication of any degradation introduced by the switch.

PC, the network temporarily displays the message on your screen. You can read it and then return to work with a single keystroke.

With the menu system, you can tell the Alliance ZSL to send or request a file; you can then exit the menu and continue on with another job. When you issue a fast series of requests (including wildcards) involving different disk drives on different machines, the program will queue them and execute them while you do something else. The program is smart enough to defer transfers that require connections to ports that are currently connected and to return to them later for execution when the ports are open.

The print queue system works in a similar manner. Your word processing program delivers the print job to the queue on your own PC. Then the networking software sends the job along to the appropriate printer.

The generic pooling capability of the data PBX lets you assign attached devices with similar functions to a pool. For example, you could pool several 1,200-bit-per-second modems as modem 1, modem 2, and so forth. When you select Modem from the menu, the switch will connect you to the first modem available. This pooling capability makes sharing modems, printers, and other devices much more efficient.

In one way, the only thing wrong with the entire Alliance ZSL System is that it is so integrated. While the manual suggests that you can establish a connection with the Alliance software and then continue the exchange using other communications software, we could not, for example, run the EasyLAN software after establishing the connection. The Alliance ZSL program kept EasyLAN locked out. This experience clearly demonstrates the problems you can have when programs are loaded on top of programs in the present versions of DOS.

You sacrifice some flexibility when you use the Alliance ZSL for connecting printers, modems, mainframes, or other devices to non-PC-compatible computers, but it's nevertheless possible. To connect non-PC-compatible computers, you must preconfigure a port. When the port becomes active, the specified connection of the computer to a printer or other device occurs automatically.

Of all the systems we examined, the Alliance ZSL does the best job of reporting

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"Hello. This is your answering machine calling...[*]... Three new messages. Message one was received at 3:52PM today."

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INCREASED SECRETARIAL PRODUCTIVITY
"This is Gordie's voice mailbox. Please wait for the tone and leave a message. My computer knows where I am at all times and will call me immediately with your message. If you need to speak to someone right away, touch zero to transfer to my secretary."

DON'T FORGET MOM!
"This is Chip. Please ...[*]... Hi, Mom. I've been waiting for your call. How's Europe? Thanks for remembering my birthday. Sorry I missed you, but I had to run some errands. See you Thursday at the airport."

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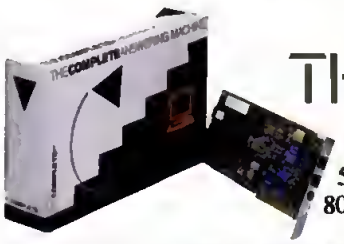

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CIRCLE 110 ON READER SERVICE CARD

■ Of the systems we examined, the Alliance ZSL does the best job of reporting system status and network activity.

system status and network activity. A status screen—accessible instantly by all systems connected to the data PBX—shows the devices named on the network, their status (on-line/off-line), and any connections in effect. You can instruct the software to create a log file that records the activity of any station. The log file presents raw data in comma-delimited ASCII file format, but almost any database management program can use the data to generate a sophisticated report of network activity.

SETUP One of our experienced technicians took about 90 minutes to make an Alliance ZSL system operational with four workstations. This time included naming the nodes, setting passwords, copying floppy disks, and running the 20-foot-long Alliance ZSL cables to each PC.

The Alliance ZSL's software includes a network configuration utility that makes setting up the system relatively easy. The manual includes clear guidance on what speed, word length, and other parameters you should select for connecting PC-compatible systems.

The RJ-45 cabling scheme is easier to hook up than the traditional DB-25 connectors and round multiconductor wire. The familiar click of the connector tends to build the confidence of people who aren't wiring experts.

PERFORMANCE The Alliance ZSL System lets each PC address the switch at maximum practical speed, and then it mediates between the potentially different speeds of the ports. Therefore you can get very different results moving files between two ATs connected on short cables and operating at 115,200 bps and two standard PCs connected over long cables and operating at 19,200 bps.

In the Alliance ZSL System, the CPU in the switch does not monitor the data stream looking for commands. Because the software is so closely tied to the hardware, the system is able to use some of the RS-232C signal lines to get the attention of the switch's CPU, instead of having to send special commands in the data stream.

Although the Alliance ZSL data PBX doesn't limit the transmission of program files by other communications software, its software can lock out some communications programs (like the EasyLAN software).

BOTTOM LINE The Alliance ZSL is an excellent turnkey solution. Since its hardware and software are so tightly integrated, it's primarily for PC-compatible connections. The Alliance ZSL's expansion capabilities should appeal to managers of growing or changing work groups, and its software should appeal to those who don't want to spend time programming before getting connected.

DIGITAL PRODUCTS INC.

NetCommander

Digital Products sells dedicated printer-sharing devices and circuit-switched systems directly and through several large OEM companies, and its contribution to the data PBX market is NetCommander. The system, which Digital calls a "sub-LAN," includes a circuit switch and connected nodes, performs file transfer and printer sharing, and leaves database management to media-sharing LANs.

Physically, NetCommander is a blue box with a few switches on the front and a number of connectors on the back. You can place the 19-inch-wide, 12-inch-deep, 5¼-inch-high box on a shelf or mount it in an equipment rack. NetCommander is available in 4-, 8-, 16-, and 30-port configurations, and you can order a version with all serial ports or one with some parallel ports, to interface with printers. We tested the 16-port version, called the NetCommander 16/250. A small blinking light on the front of the unit monitors its CPU and indicates that the unit's processor isn't locked up, but it doesn't tell you anything about data flowing through the data PBX.

Electrically, NetCommander uses a Z-80 CPU to monitor the ports and to make connections among them on request. The amount of memory in the machine depends on the number of attached ports, but it can vary from 250K bytes to 1 megabyte. The serial ports operate at speeds of up to 19,200 bits per second. The system has slightly more than 16K bytes of permanent internal programming and 2K of battery-backed erasable RAM for customized options.

CAPABILITIES Operationally, NetCommander excels at printer sharing. It can store up to 64 print jobs in a queue that is expandable to up to 500K bytes. Many other data PBXs will do little more than queue your call for connection to the port

PC MAGAZINE FACT FILE

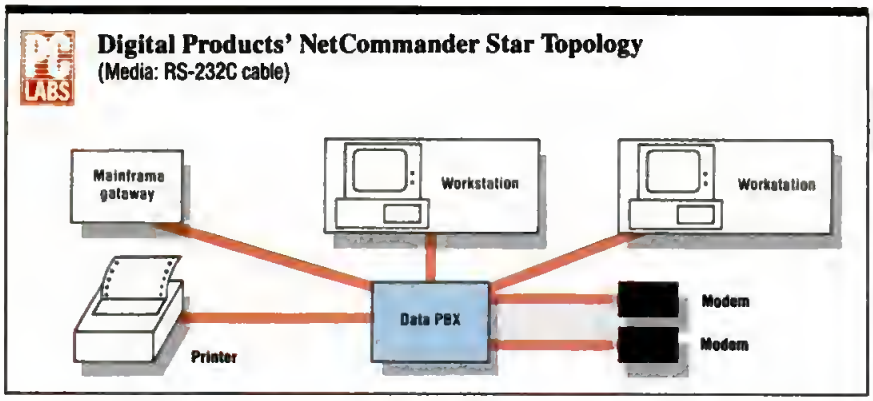
NetCommander
Digital Products Inc.
108 Water St.
Watertown, MA 02172
(617) 924-1680

List Prices: NetCommander 4, including 250K RAM, 4 serial ports, Z-80 CPU, *Auto Install* software, $1,095. NC 7, including 250K RAM, 4 serial and 3 parallel ports, Z-80 CPU, *Auto Install* software. $1,495. NC 8, including 250K RAM, 8 serial ports, *Auto Install* software, $1,695 (for RJ connection), $1,895 (for DB connection). NC 16/16, including 16K RAM, 16 serial ports, Z-80 CPU, *Auto Install* software, $1,895 (for RJ connection), $2,195 (for DB connection). NC 16/250, including 250K RAM, 16 serial ports, *Auto Install* software, $2,695 (for RJ connection), $2,950 (for DB connection).

Software: *Auto Install:* included in system; requires 256K RAM, DOS 2.0 or later; not copy protected. Blast Communications software: $250 to $5,500, depending on operating system the software is translating from; requires 256K RAM, DOS 2.0 or later; copy protected. EasyLAN networking software: $100 per disk, requires 20K RAM per satellite, hub requires the total amount of RAM of each satellite, DOS 2.0 or later; not copy protected.

In Short: A powerful tool for work group connectivity, it is the most flexible and full-featured of the data PBXs we reviewed, but also the most complex to set up.

CIRCLE 653 ON READER SERVICE CARD



(1) the NetCommander unit uses a Z-80 CPU to monitor the ports and make connections among them on request. The system uses standard DB-25 connectors. Digital Products markets (2) Server Technology's EasyLAN software to allow you to exchange files among attached computer systems. The company also provides an Auto Install disk to make setup easier.

the printer is attached to. NetCommander allows you to download the print job to the circuit switch and move on to other tasks. The stored program in NetCommander generates banner pages between print jobs and automatically resets the printer in case a previous application sent printer setup codes that weren't cancelled. Since the data PBX recognizes an end-of-job code, it knows whether it should send a file to the printer—without waiting for a time-out or an Endspool command like some other sophisticated media-sharing networks use.

You can command NetCommander to connect a workstation to a printer port by running a DOS batch file when you start the word processing program, by manually embedding codes in the print job's text header, or by using the applications program's printer selection menu.

Instead of buying a modem for every PC, you can attach two or three modems (perhaps more-expensive, high-speed models) to ports located on the NetCommander. NetCommander passes through control signals for modems that require the computer to control RS-232C pin 20 to hang up.

NetCommander also buffers transmissions so that the workstation can always address the switch at the same speed. In other words, you don't have to use one transmission speed to control the switch and then change speeds to work through the slower modem. The circuit switch mediates the differences in speeds internally.

SOFTWARE FOR SWITCHES While NetCommander excels at sharing modems and printers, it also does a good job of allowing file exchanges among attached devices. Digital Products markets EasyLAN software from Server Technology (see *PC Magazine*, Volume 6 Number 12, for a review of EasyLAN). The EasyLAN software uses special commands similar to DOS commands to allow access to the disk drive of a PC connected through a serial port. The software sits in the background mode of every PC on the circuit-switched network. When two PCs are connected through the data PBX, one operator can access the disk drives of the other machine without interrupting or needing any help from the second operator.

The EasyLAN software also allows

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PCs attached to the data PBX to share printers attached directly to the PC instead of to the data PBX switch. This type of resource-sharing adds flexibility to a work group system.

SETUP NetCommander has many capabilities, and once it is set up it is nearly invisible to workstation users. Setting it up, however, is hardly the intuitive task that its advertising proclaims.

NetCommander's owner manual, installation and reference manual, and applications guide are detailed publications with indexes, glossaries, examples, and diagrams. To get the full benefit of the system, you need to understand the material in all three documents.

Digital Products provides an *Auto Install* floppy disk designed to make setting up the system easier. The disk holds a series of batch files that send commands to the switch. The concept is that you select the task to be done and then use a menu to call the batch job to do it. The problem is that you have to know a great deal about the system (if ports are DTE or DCE, if graphics characters are used, and so forth). Then you have to communicate what you know to the batch files so that they can send it to the switch. Our experience, confirmed by those we talked to who use large NetCommander systems, is that it is easier for someone with basic programming skills to enter the commands into the switch directly.

You can use *Qmodem* shareware, or other communications programs such as *PC-Talk* or *Crosstalk*, to turn a PC into a terminal able to communicate with the circuit switch.

You program the switch itself by using a series of relatively simple commands. You get the attention of the switch by sending two tilde (~) characters (ASCII code 126). Sending a command such as ~~S (Status) to the switch causes it to display the port's current connection status. The ~~D (Download) command tells the data PBX to prepare to receive a string of parameters describing the configuration a port should take.

Port configuration variables include security passwords that allow you to limit access to a port or to prevent certain combinations of port-to-port connections. Another important parameter is the selection of the graphics option on a port. The graphics option tells the processor in the NetCommander to stop monitoring the line. This permits transparent binary transmission of files (instead of using ASCII) and eliminates any possibility that the NetCommander's CPU will respond to characters not intended for it. You need to use the graphics option if you use a communications program like *Qmodem* or the Easy-LAN package to move binary data through the data PBX.

OPERATION After the switch is programmed, you give each port a unique name appropriate to its use. Ports could be called John, Harry, and Fred or shipping, warehouse, and accounts payable. Attached printers can be called laser, LQ, or any name that makes sense to system users. You can either give each user batch files that transmit the appropriate call setup directions to the switch or let him type in the tilde character and an appropriate port name. The NetCommander program is case sensitive, so you should give the switch all logical combinations of upper- and lowercase letters, using names such as LASER, Laser, and laser.

After it receives the request for connection, NetCommander either connects the ports or sends back one of several messages stating that the port is busy or unavailable. Aside from this interaction, the switch is literally invisible to the people using it for connections.

PERFORMANCE NetCommander is the type of system that uses data paths through the switch to connect the ports. Therefore, the total capability of the system to pass data is divided among the data paths established at any one time.

The throughput of NetCommander is over 50K characters per second. According to the manual, the average throughput varies slightly with the number of sessions NetCommander is handling. With three simultaneous data paths established (six stations communicating), the average throughput is approximately 2,000 cps. In general terms, this rate is equivalent to a transmission speed of about 16,000 bps. Because parallel printer ports operate at over 30,000 bps, running a parallel printer

The Connectivity Decision Guide

This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

Reviews originally appeared in *PC Magazine:*

- Volume 5 Number 21
- Volume 5 Number 22
- Volume 6 Number 1
- Volume 6 Number 2
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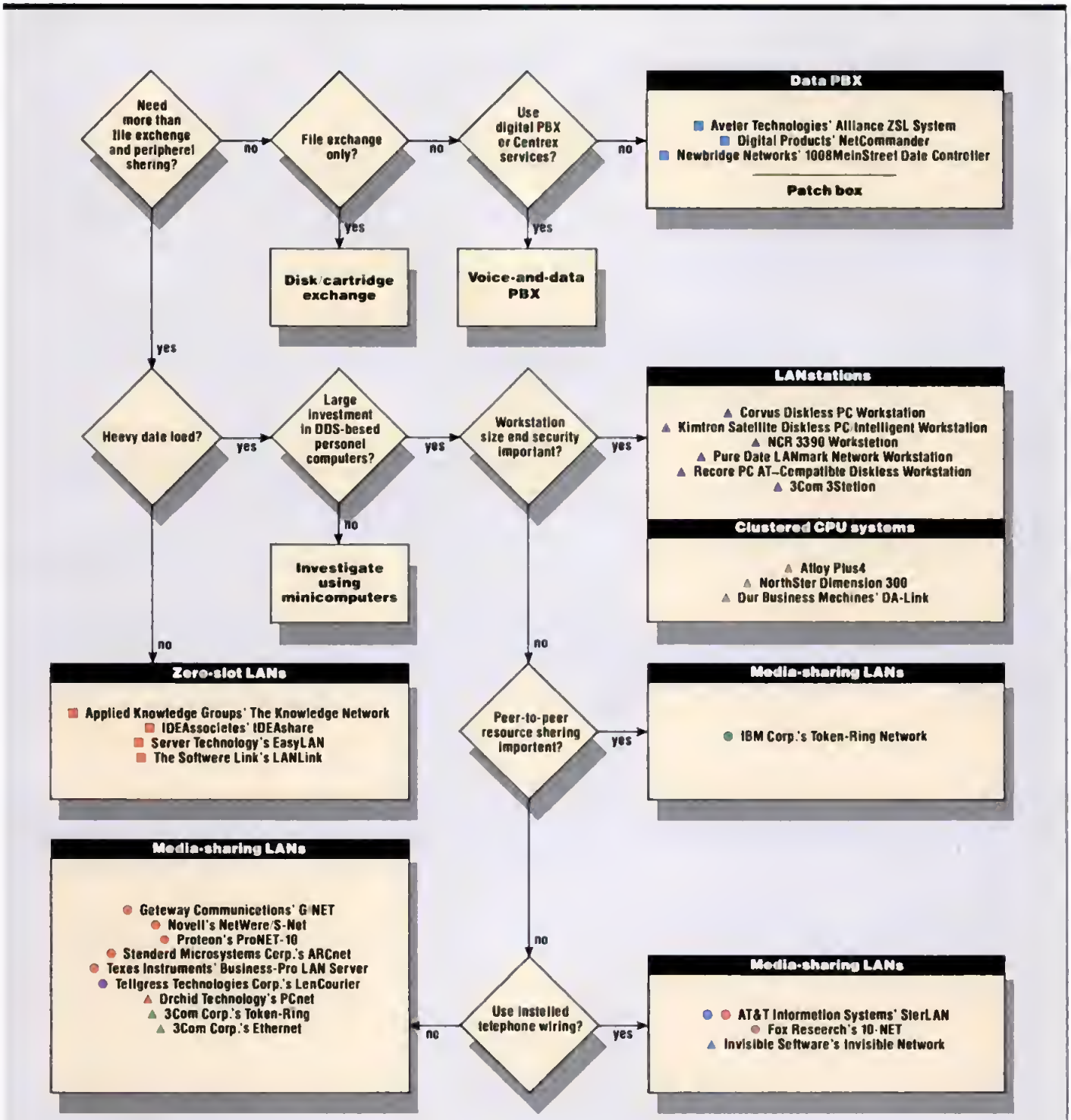
Need more than file exchange and peripheral sharing?
no
File exchange only?
no
Use digital PBX or Centrex services?
no
Data PBX
Avaler Technologies' Alliance ZSL System
Digital Products' NetCommander
Newbridge Networks' 1008MainStreet Data Controller
Patch box
yes
Disk/cartridge exchange
yes
Voice-and-data PBX
yes
Heavy data load?
yes
Large investment in DOS-based personal computers?
yes
Workstation size and security important?
yes
LANstations
Corvus Diskless PC Workstation
Kimtron Satellite Diskless PC/Intelligent Workstation
NCR 3390 Workstation
Pure Data LANmark Network Workstation
Recore PC AT–Compatible Diskless Workstation
3Com 3Station
Clustered CPU systems
Alloy Plus4
NorthStar Dimension 300
Our Business Machines' DA-Link
no
Investigate using minicomputers
no
Zero-slot LANs
Applied Knowledge Groups' The Knowledge Network
IDEAssociates' IDEAshare
Server Technology's EasyLAN
The Software Link's LANLink
no
Peer-to-peer resource sharing important?
yes
Media-sharing LANs
IBM Corp.'s Token-Ring Network
Media-sharing LANs
Gateway Communications' G/NET
Novell's NetWare/S-Net
Proteon's ProNET-10
Standard Microsystems Corp.'s ARCnet
Texas Instruments' Business-Pro LAN Server
Telegrass Technologies Corp.'s LanCourier
Orchid Technology's PCnet
3Com Corp.'s Token-Ring
3Com Corp.'s Ethernet
no
Use installed telephone wiring?
yes
Media-sharing LANs
AT&T Information Systems' StarLAN
Fox Research's 10-NET
Invisible Software's Invisible Network

through NetCommander degrades other activities such as file transfers that may be going on at the same time.

Our experience showed NetCommander can handle any tasks appropriate for circuit-switched systems in a work group. But before you attach dozens of PCs and printers to NetCommander, consider how heavily you will use them and what tasks they will be doing. That assessment will give you a better idea of what to expect in total system performance.

BOTTOM LINE Once you get to know NetCommander, you'll like it. The system is the most flexible and full-featured of the data PBXs we reviewed, but it is also the most complex to set up. NetCommander is a powerful tool for work group connectivity, but plan on spending at least 2 full days reading, planning, and programming to get it operating.

NEWBRIDGE NETWORKS INC.

1008MainStreet Data Controller

The term *data controller* is yet another description of a data PBX. Newbridge Networks markets two data controllers: the 1008MainStreet Data Controller, with eight serial ports, and the 1032MainStreet Data Controller, with eight serial ports and a card nest for six cards.

We looked at the 1008MainStreet Data Controller, a small flat box with four DB-25 connectors for RS-232C cables on each of two sides. Except for an AC pilot light, the 1008MainStreet has no indicators. The only switch is an on/off/reset switch, which you shouldn't need to use after you've set up the system.

The 1008MainStreet gets its power from a wall socket transformer. You can mount it in a closet, under or alongside a desk, or in any other place where you can connect the cables to it. You can connect the eight ports on the 1008MainStreet to PCs, printers, modems, plotters, and other devices with a serial interface.

The 1008MainStreet uses customized LSI chips and a controller to make its data connections. A program stored in ROM responds to commands from a terminal or PC that activates the "console" mode.

CAPABILITIES The 1008MainStreet comes with custom RAM-resident software that allows users to select functions from a display of sliding and pull-down menus. You can use the menu to select equipment (such as printers, plotters, and modems) and functions, including file exchanges with the machine at the other end.

You can assign several levels of security to the ports on the 1008MainStreet. To prevent unauthorized users of a node from getting into the system, you can program the 1008MainStreet to request a password when a station first makes contact. It can also request additional passwords when a user makes a request to be connected with specific ports. This feature can restrict the use of equipment to specific individuals, regardless of what node they are using to contact the switch.

The 1008MainStreet is not limited to using its own software. When we ran the data PBX with the EasyLAN software, it worked well. Similarly, you can use *Crosstalk* or other communications software, instead of the software Newbridge supplies, to exchange files or control a modem through the 1008MainStreet. This capability might be particularly useful if you are using a modem attached to the data PBX to call a host computer and you want to take advantage of the script files available in modern communications programs.

SETUP The 1008MainStreet is less flexible in its treatment of printers than NetCommander, but it is also easier to program for the functions it does perform. Its ease of programming is slightly offset by the possible need to physically configure jumpers on the system board. Each port has six sliding block jumpers used to adapt the port for the RS-232C signaling of the attached devices. You must decide if devices operate as data terminal equipment or data communications equipment and what RS-232C lines they use for control. If the jumpers aren't set correctly, some systems will not communicate with the data PBX. So although it's not difficult to set up the 1008MainStreet, anyone who isn't comfortable changing jumpers on a circuit board or familiar with RS-232C wiring might be challenged by the task.

You access the console mode of the switch's ROM software by using a special password. The password allows the system administrator to configure and maintain the network.

The administrator configures each port individually through the Set command. The dozen or more options that the Set command can configure include the speed of the port, the ability to queue on calls to busy ports, limitations on initiating and receiving calls, the amount of time a connection can be inactive before it is dropped, and transparent operation.

The transparent operation option makes the controller transparent in the data stream. The administrator selects this option when a port is used to pass binary data files using programs like the EasyLAN software or when an ASCII file has many embedded control codes. Making the controller transparent prevents it from reacting to control codes or other sequences in the data files being transferred.

The 1008MainStreet can automatically adjust to the speed of an attached device within the limits of 300 to 2,400 bits per second. This feature is particularly useful when you're using dial-in modems that might operate at different speeds, depending on factors such as the quality of the lines and the capabilities of the caller's mo-

PC MAGAZINE FACT FILE

1008MainStreet Data Controller
Newbridge Networks Inc.
13873 Park Center Rd.
Herndon, VA 22071
(703) 834-3600
List Price: 1008MainStreet Data Controller, including 8 serial ports, *EasyStreet*, $1,099. 1032MainStreet Data Controller, including 8 serial ports, card nest for 6 cards, *EasyStreet*, $1,850. Each additional 1032E 8-port card for 1032MainStreet Data Controller, $740.
Software: *EasyStreet*, included in system; requires 70K RAM, DOS 2.0 or later; not copy protected.
In Short: A small but powerful data PBX that can make four connections between eight nodes at a time. The easy-to-use software is effective but prohibits wildcard transfers. The system permits use of other programs such as EasyLAN software for sharing disk drives.

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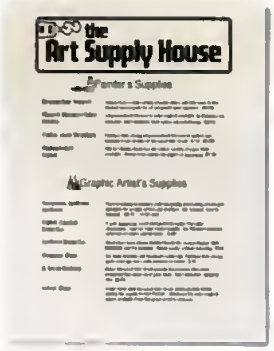

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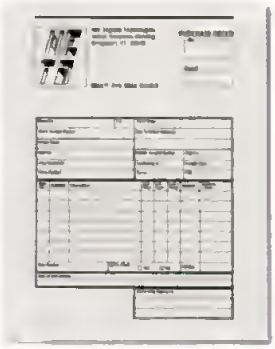

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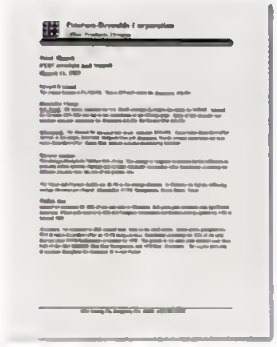

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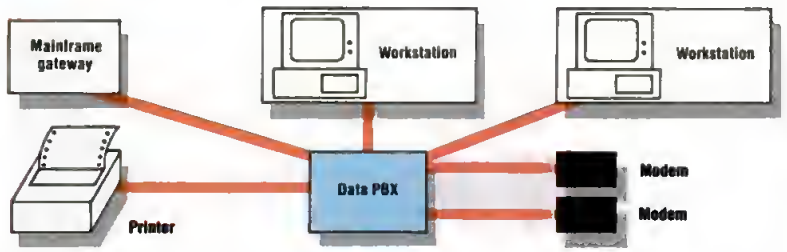
Newbridge Networks' 1008MainStreet Data Controller
Star Topology (Media: RS-232C cable)



(1) the 1008MainStreet Data Controller has four DB-25 connectors for RS-232C cables on two of its sides. You can connect the eight ports to PCs, printers, modems, and other serial devices. The 1008MainStreet uses customized LSI chips and a controller to make its data connections. The PBX has a program stored in ROM that responds to commands from an attached workstation. The system also comes with (2) custom RAM-resident software that allows you to select functions from a menu display.

dem. Since the 1008MainStreet doesn't mediate between different equipment speeds above 2,400 bps, you must set, at each end, the specific speed for faster file transfers between PCs.

The 1008MainStreet's easy-to-read manuals (one for the switch and one for the software) don't include a glossary or an index, but they have several appendixes with useful data. The generic descriptions of DTE and DCE connectors are clear, but a few pages listing the features of specific equipment would be useful.

The *EasyStreet* communications software is a "point and shoot" program that works reliably. You can initiate a connection with another node on the switch through the program and then pop it out of the way so that you can run terminal-emulation software. Hitting the Right and the Left Shift key at the same time (although you can change the key assignments if you like) will call the program while you are creating a spreadsheet or text document, and this will direct the output of your serial port to a specific printer.

Our only complaint about the program is that the file transfer commands in *EasyStreet* don't accept wildcard (* and ?) commands. To transfer a series of related files, you have to type the exact name of each file and repeat the process many times.

EDITOR'S CHOICE

- **Alliance ZSL System**

While any of these systems is a good choice for work group connectivity, the Alliance ZSL System gets our nod for its power and its easy-to-use software. The Alliance switch moves data at high speeds, and the software does an excellent job of accepting directions and carrying them out while you do something else. The tight integration between the software and the switch might interfere with some other communications programs, but the capability of the integrated system is excellent. Unique features such as an activity log file, bulletin board, and peer-to-peer messaging make this system especially useful for improving work group productivity.

PERFORMANCE The 1008MainStreet can move data at speeds of up to 19,200 bps. In our tests the throughput of one connection did not degrade as we made other connections and moved data through them. The system made connections quickly, and the software in the switch performed reliably.

The technical staff at Newbridge Networks says that the 1008MainStreet has a data bandwidth of 200,000 bps. In theory, you can route up to ten simultaneous connections at 19,200 bps through the switch without any degradation occurring.

BOTTOM LINE The 1008MainStreet is a small but powerful data PBX that can make four connections between eight nodes at a time. Its pop-up software is easy to use and effective (except for wildcard transfers), and it can use other programs such as the EasyLAN software for disk drive sharing. The 1008MainStreet offers an effective, low-cost answer to work group connectivity problems.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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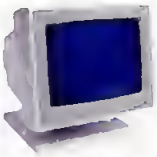

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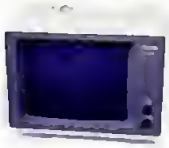

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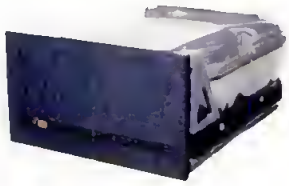

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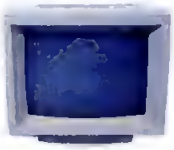

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20MB-$459 **30MB-$499**

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		EX-800	**$499**
		EX-1000	**$599**
LX-800	**$199**	LQ-800	**$439**
FX-86E	**$369**	LQ-1000	**$669**
FX-286E	**$499**	LQ-2500	**$999**

Okidata Printers

192+ 80 col dot matrix with graphics capability, 180 cps. **$365**

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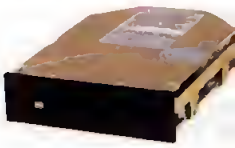
XT MiniScribes

Kits include controller card, mounting hardware, cables and instruction manual. Both with 85ms access time.



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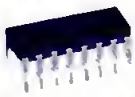
HP LaserJet II and Plotters

HP LaserJet Series II printer	**$1995**
HP 7440 Color Pro Plotter	**$999**
HP 7475 Plotter	**$1395**

Chips

Memory



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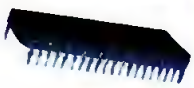
64K (150ns)	**$9**
256K (120ns)	**$35**
256K (150ns)	**$29**

Co-Processor



8087-3	**$129**
8087-2	**$159**
80287	**$219**
80287-8	**$269**

Monographics Card

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AST Advantage w/128K, extended memory to 1.5MB, serial & parallel port. **$399**

EGA Card

640 X 350 Pixels, 256KB display RAM, MDA, CGA, EGA compatible.

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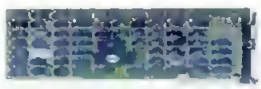
Color Card



640 X 200 w/parallel port CGA compatible. **$79**

Hercules Color Graphics card w/parallel port 640 X 200. **$155**

MFC Card

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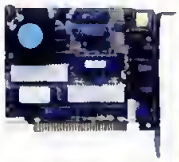
AST SixPakPlus has 384KB RAM, serial port, memor expansion, parallel port, clock/calendar, software. **$19**

Modems

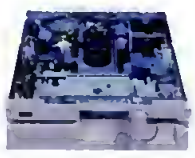
Hayes Internal
1200 baud **$349**
2400 baud **$529**

Hayes External
1200 baud **$389**
2400 baud **$599**



Everex Internal
1200 baud **$129**
2400 baud **$599**

Teac Floppy



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CIRCLE 393 ON READER SERVICE CARD

THE TECHNOLOGY OF TRANSFER

If you buy a PS/2 model from IBM or use a laptop frequently, you'll have to transfer data between 3½- and 5¼-inch disks. Here's how to do it.

If your travel plans include taking along your laptop (and that's a likely possibility for more and more people as the portable machines command a greater share of the PC market), loading and unloading its data will become as much a part of life as packing and unpacking a suitcase. There are many ways to accomplish the task.

Hardware and software methods and combinations of those two make the job possible, but the speed, ease, and practicality of the task will vary according to how you go about it. The best way of going about it will likely depend on the equipment you are using and the setting in which you are using it. Some methods are not available to certain brands.

If, for instance, 25 salesmen in the field are using laptops and returning with their data to a single office, it becomes cheaper and more practical to install 3½-inch drives on a central PC than it does to require each member of your sales force to lug around an external 5¼-inch drive.

HERE TO STAY The industry appears to have standardized around the 3½-inch disk format. With the introduction of IBM's new Personal System/2 machines that use 1.44-megabyte 3½-inch disks, it looks like the 3½-inch format is here to stay. IBM's new machines can read and write 720K-byte disks, and owners of the PS/2s will also be able to buy a $33 package, including adapter and software, that allows them to transfer data one way from their old PC to the PS/2 via the parallel port.

The Zenith Z-171, the new Compaq Portable II and III, the Sharp PC-7000A and PC-7100, and the Quadram Datavue 25 laptops come equipped with 5¼-inch drives. But those who have opted for other machines and those who aren't planning to trade in their PCs for the New Blue may want to consider some of the transfer techniques in our review.

PC Labs tested 18 products—some hardware, some software, some device drivers that package cables with floppy disks—to bring you a sample of what's on the market. This is not all that is out there. If you decide to transfer data via a null modem (not a modem, per se, but a device that links serial ports on both computers; it can be made for as little as $10 with two serial connectors and a cable), there are any number of communications packages you can use. We reviewed one of the more elaborate, *Crosstalk XVI*, as an example.

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■ DATA TRANSFER

Disk drives that go with your PC are a direct way to transfer data. Clockwise from the left: the Zenith 5¼-Inch Disk Drive, the Manzana MDP3A drive with MUX board, the Manzana MDQA drive, the J&M 3½-Inch Internal Disk Drive, and the Manzana MDI3 internal drive.

Photographs: Thom O'Connor

Similarly, many manufacturers produce external 5¼-inch drives. We looked at Zenith's as an example.

THE EXTERNAL OPTION There are several advantages to using additional external drives of either size. You use familiar DOS commands to copy files and format disks. Since this is a disk-to-disk transfer, it is relatively fast and easy. Connecting an external 3½-inch drive to your PC or XT can be as easy as plugging the cable from the drive into the DB-37 floppy disk connector and plugging the drive's power supply into the wall.

There are a couple of disadvantages to external drives, however. If you have a hard disk, you may have to transfer files that are larger than the 360K bytes a single 5¼-inch floppy can hold. When that happens, data transfer becomes an unwieldy and time-consuming process that requires multiple disks.

AT owners run into yet another complication. Because the AT was designed for a hard disk, and not double floppies, it lacks the DB-37 connector that allows convenient, plug-in installations for external drives. Many PC compatibles and clones also omitted the connector. In these cases, you must install a DB-37 connector to the floppy disk controller. And because the DB-37 was designed to hook to a drive with a power supply, you must also connect cables to the PC to power the external drive.

LINKS AND BRIDGES The most elegant options to the problem of data transfers are device driver kits like *Lap-Link*, *The Brooklyn Bridge*, and *PC Liaison*, reviewed here. These allow you to use DOS commands to move data via a cable that connects your PC and laptop. They allow you to address the desktop PC's disk drives as logical drives on the laptop and to use your favorite DOS shell to transfer files selectively. They also allow hard-disk-to-hard-disk transfers if you are one of the lucky few who has a hard disk on both desktop and laptop. And they are fast—very fast.

They use a unique mode of the PC's UART (Universal Asynchronous Receiv-

Other solutions include two products from Toshiba. Clockwise from the upper left: the Toshiba ND354A universal installation kit, including several faceplates, tBM's Model 4865 drive, the Tigertronics 853W drive, and the Toshiba Floppy Link system.

er/Transmitter) chip to transfer data at 115,200 bits per second. Zero-slot local area networks (LANs) first used this mode of the UART, the chip that runs the PC's serial port, to expand communications speed almost ten times beyond the normal 9,600 bps. *The Brooklyn Bridge*, in fact, is eight times as fast as *Crosstalk XVI*.

Finally there are two transfer methods that we did not review for comparison. Both are basically services. Both are expensive. They are:

- Third-party transfer services that receive your 5¼-inch disks and, for fees ranging from $10 to $25 per disk, return 3½-inch disks. Some laptop dealers have the necessary equipment and provide this service for their customers. If your transfer needs are limited or your pocket is deep enough, you may want to consider such a service.
- The very slow and very expensive option of transferring data via an electronic mail service. It can be done. Assume you transfer your data on Compuserve: at Compuserve's non-prime time rate of $12.50 per hour for 1,200 bps, a 360K-byte disk would take nearly an hour to upload, and about an hour to download, and about $25 for the transfer. During prime-time hours, it would be even more expensive.

COMTEK DATASYSTEMS LTD.

Paranet

Parallel interfaces with 10 or 15 wires in the cable are usually faster than serial connections that have 3. Comtek Datasystems apparently took that into account in designing *Paranet*. *Paranet*, which sells for $150, is a device driver product, like *PC Liaison* or *The Brooklyn Bridge*, that makes the connection with the parallel rather than serial port of your computers.

Although *Paranet* is faster than the normal 9,600-bps serial port maximum used by *PC Liaison*, it is not as fast as the 115,200-bps products, like *The Brooklyn Bridge*. It took 5 minutes to transfer the contents of the PC-DOS 3.2 distribution disk—as opposed to *The Brooklyn Bridge*'s time of just over 2 minutes.

Paranet is also sensitive to the CPU

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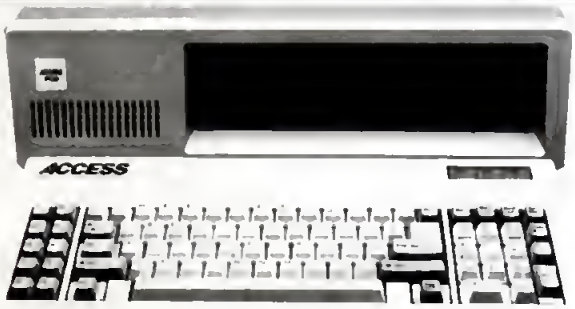

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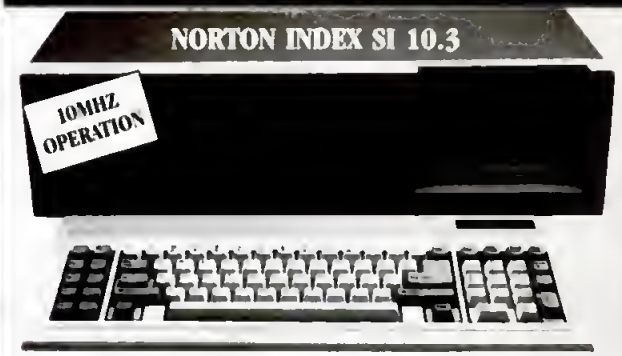

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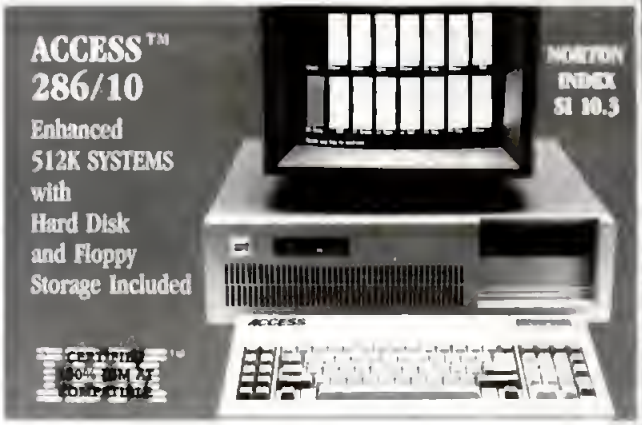

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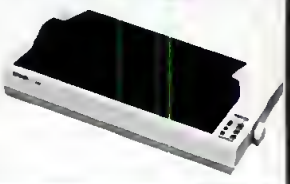
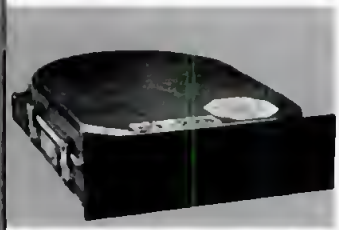
LX-86 *120/16 CPS 8.5" Parallel*	199.00
LQ-800 *180 COL/ 60 CPS*	475.00
LQ-1000 *180 COL/ 60 CPS NLQ*	669.00
LQ-2500 *180 CPS/ 132 COL*	899.00



ACCESS™ "AT" STORAGE

SEAGATE™ 42MB HIGH PERFORMANCE "AT" HARD DRIVE



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71MB *28MS* HARD DISK

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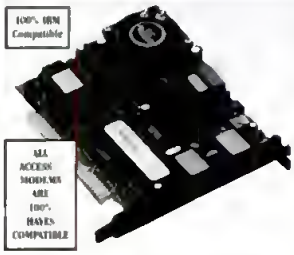

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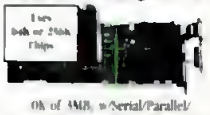

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speed of the computers. A transfer between an IBM PC-XT and a Toshiba T1100 took several times as long as a transfer between an AT and a Toshiba T3100. The IBM PC's designers apparently assumed that the parallel ports were going to be used primarily as printer ports that didn't need sophisticated interrupts. The serial ports would always need to do both input and output so they were given interrupts and, therefore, took less CPU power to run.

Paranet, like *The Brooklyn Bridge*, can run with either machine as the master, so your PC can use the laptop's 3½-inch drives or the laptop can use your PC's hard disk. A separate driver must be loaded into the master system for each drive on the slave to be used.

Because of differences in cluster sizes, *Paranet* cannot access hard disks of more than 20 megabytes on masters running DOS 3.1 or later if the slave is not also running 3.1 or later.

Paranet is a good product that has the advantages of the device driver method without being so slow that it becomes bothersome. Users without a free serial port and DG/One owners may want to consider it, since the DG/One has a standard parallel port and a nonstandard serial port that can't run the 115,200-bps products.

PC MAGAZINE FACT FILE

Paranet
Comtek
Datasystems Ltd.
280 Alberta St., #701
Ottawa, Ontario, Canada
K1P 5GB
(613) 236-1487
List Price: $150

Requires: One parallel port.
In Short: A solidly performing transfer product that uses a parallel port rather than a serial port. Not copy protected.

CIRCLE 636 ON READER SERVICE CARD

DATA GENERAL Corp.

PC Liaison

Introduced more than 2 years ago, Data General Corp.'s $180 *PC Liaison* was the first of the device driver type products. It is the only one that's specifically designed for the Data General One. Since the DG/One uses a different UART chip than the PC to control its serial port, *PC Liaison* lacks the 115,200-bps mode that makes *The Brooklyn Bridge* so fast. In fact, *PC Liaison* is the slowest device driver product tested for this review.

PC Liaison allows you to access your PC's drive from the DG/One. Both sys-

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CIRCLE 120 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

PC Liaison
Data General Corp.
4400 Computer Dr.
Westboro, MA 01580
(617) 366-8911
List Price: $180
Requires: 192K RAM, one floppy drive, DOS 2.0 or later, one asynchronous port.
In Short: A device driver designed for DG users 2 years ago. It works well but is very slow in comparison with *The Brooklyn Bridge*. Not copy protected.

CIRCLE **635** ON READER SERVICE CARD

tems must run the same version of DOS, which may require an update for your DG (it did for mine). *PC Liaison* took about 15 minutes for the DOS disk transfer test—eight times slower that *The Brooklyn Bridge*. *PC Liaison* is a good option for the DG/One, which can't run *The Brooklyn Bridge* or other 115,000-bps products. You can still use your favorite DOS shell to load up your laptop. Its failing is its poky 9,600-bps data rate.

DCA/CROSSTALK COMMUNICATIONS

Crosstalk XVI

Back in the Stone Age—BPC, or Before Personal Computers—data transfers were made between different CP/M machines with communications software such as *Crosstalk XVI*. You can use this same method today to transfer data from 5¼-inch disks to 3½-inch disks. There are pros and cons to using this method, but the primary pro is the flexibility it offers. You can transfer data to your shiny new laptop from any computer that can run *Crosstalk XVI*, using the Xmodem protocol, from a host as new as an AT or as old as a CP/M-based Osborne. It also works with non-IBM-compatible MS-DOS machines such as the NEC APC or Victor 9000.

The disadvantage of this method is that *Crosstalk XVI* doesn't lay everything out for you. You don't get the disks, cables, and detailed instructions that come with kits like *Lap-Link*. To be legal, you have to buy a copy of *Crosstalk XVI* at $195 per program for each machine and construct the cable that connects them (see diagram in Volume 5, Issue 22, page 121). This is a gritty game where real men make their own cables and strip the wire with their teeth. The same holds true for any communications you would use to transfer data. The best ones let you request whole batches of files at one time—the contents of an entire subdirectory on your hard disk or all

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CIRCLE 328 ON READER SERVICE CARD

your command files, for instance.

Crosstalk XVI is a general-purpose communications program, so you'll have to know how to select the data exchange functions. But once you get *Crosstalk XVI* set up, it's not all that difficult to use. You can even run the whole setup from one machine by using the RQ (Request) command that downloads a group of files from the remote machine.

PC MAGAZINE FACT FILE

Crosstalk XVI
DCA/Crosstalk Communications
1000 Holcomb Woods Pkwy., #440
Roswell, GA 30076
(404) 998-3998
List Price: $195

Requires: 128K RAM, DOS 2.0 or later.
In Short: Not specifically designed for data transfers, *Crosstalk* laboriously carries out the chore and even then requires some prior knowledge. Not for the uninitiated. Not copy protected.

CIRCLE 640 ON READER SERVICE CARD

Crosstalk XVI, however, is limited to 9,600 bps, which means that data transfers are slow. It took about 15 minutes to transfer the contents of the DOS 3.2 distribution disk.

■ *Crosstalk XVI* is a general-purpose communications program, so you'll have to know how to select the data exchange functions.

Some people do use *Crosstalk XVI* to do their data transfers, but device drivers like *Lap-Link* or *The Brooklyn Bridge* are more efficient. With *Lap-Link* and *The Brooklyn Bridge* priced at $129.95, it's just not worth it.

IBM CORP.

IBM Model 4865

When IBM introduced The PC Convertible as its laptop, it also released two external 3½-inch floppy disk drives for PCs, one for the PC or XT and another for the AT. In typical IBM fashion, the company came out with a new version of DOS 3.2 to

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CIRCLE 498 ON READER SERVICE CARD

FACT FILE

IBM Model 4865
IBM Corp.
Consult your local authorized IBM dealer.
(800) 447-4700
List Price: $395
Requires: DB-37 connector on floppy controller, DOS 3.2.
In Short: A high-quality drive that performs neither better nor worse than other external 3½-inch external drives.

CIRCLE 651 ON READER SERVICE CARD

support the machine instead of relying on existing software.

Big Blue's drive uses an external DB-37 connector on the PC or XT floppy disk controller. Still, the DB-37 has no power on it, so the 3½-inch floppy drive requires a bit of creative cabling to draw power from the PC. For those of us who can solder with some confidence, Manzana Microsystems' method of passing power is neater (see Manzana review), but IBM's is safer for those who'd rather not risk destroying their floppy controller with a hot soldering iron. It uses a wye cable that connects one drive, the power supply, and the 3½-inch drive.

■ IBM's drive uses an external DB-37 connector on the PC or XT floppy disk controller. The DB-37 has no power on it, so the 3½-inch drive requires creative cabling.

Like Manzana, IBM has a card that connects to the floppy controller for the AT. Here again, IBM made no provision for compatible systems. Installing this drive in an AT&T 6300 or any other computer with the floppy controller on the motherboard requires a long cable and a trek through the innards of your computer, an adventure that is likely to drive you to Witt's End.

It should be the option of choice, however, for those who need a Blue solution for their data transfer. Frankly, there is virtually no performance difference between any of the 3½-inch floppy drives in the group that PC Labs tested. You would be well served by any of them.

CIRCLE 193 ON READER SERVICE CARD

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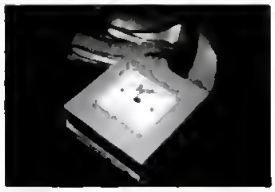

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CIRCLE 116 ON READER SERVICE CARD

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*Patent #4,578,579

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CIRCLE 132 ON READER SERVICE CARD

■ DATA TRANSFER

J&M SYSTEMS LTD.

J&M 3½-Inch Internal Disk Drive

J&M Systems Ltd., like Tigertronics, supplies mail-order, low-cost, internal 3½-inch floppy disk drives. The main advantage of the J&M drive is the device driver supplied. It allows you to run the drive under DOS 2.1.

PC MAGAZINE FACT FILE

J&M 3½-Inch Internal Disk Drive
J&M Systems Ltd.
15100-A Central, SE
Albuquerque, NM 87123
(505) 292-4182
List Price: Internal drive with *Mach 3.5* device driver software and *ARC* file compression and backup utility, $225; external drive with case, power supply, cables, *Mach 3.5*, and *ARC*, $295.
Requires: DOS 2.0 or later.
In Short: Versatile because it allows you to run under older versions of DOS, this mid-priced product is, nevertheless, a bit difficult to install.

CIRCLE 650 ON READER SERVICE CARD

J&M uses Matsushita drives, and, rather than use adapter cables, the drives have a PC board that provides a more stable platform for the connectors. Its data connector is upside down from those on standard IBM drives. You have to twist the cable to put it through the little space between the drive and the power supply.

MANZANA MICROSYSTEMS INC.

Manzana MD13
Manzana MDP3A
Manzana MDQA
Manzana MDQX

Manzana Microsystems Inc. makes five different models of 3½-inch floppy disk drives for desktops. Their prices range from $355 for PC, XT, and AT compatibles to $535 for an AT-compatible external drive complete with power supply. Other models accommodate Tandy computers. There is a drive for just about everybody.

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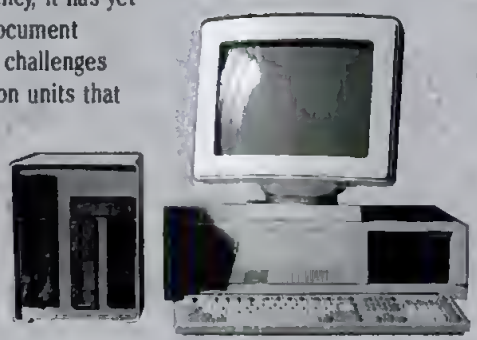

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CIRCLE 209 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

Manzana Microsystems Inc.
7334 Hollister Ave., Suite B
Goleta, CA 93118
(805) 968-1387

Manzana MDP3A
List Price: $495
Requires: 128K RAM, DOS 2.0 or later, DB-37 connector on floppy controller.
In Short: An external 3½-inch floppy disk drive for PC and XT compatibles complete with software cable and power supply.
CIRCLE **649** ON READER SERVICE CARD

Manzana MDQA
List Price: $249
Requires: 128K RAM, DOS 2.0 or later, DB-37 connector on floppy controller.
In Short: An external 3½-inch floppy disk drive for PC and XT compatibles. Package comes with software and cables. Uses power from PC. Some soldering required.
CIRCLE **648** ON READER SERVICE CARD

Manzana MDQX
List Price: $395
Requires: 128K RAM, DOS 2.0 or later.
In Short: An external 3½-inch floppy disk drive for AT compatibles that comes with software, cable, and interface card. Uses power from main power supply.
CIRCLE **647** ON READER SERVICE CARD

Manzana MDI3
List Price: $355
Requires: 128K RAM, DOS 2.0 or later.
In Short: An internal 3½-inch floppy disk drive for PC, XT, and AT compatibles. Comes with software and mounting hardware.
CIRCLE **646** ON READER SERVICE CARD

rate, and, although 3½-inch drives are available for less from mail-order houses, the quality makes Manzana's drives worth that little bit extra. Manzana's *3FIVE* device driver allows its drives to run under the venerable 2.1 version of DOS.

Manzana's solution to the absence of a DB-37 connector in the AT is the MUX (multiplexor) card. It provides the DB-37 function by plugging into a short slot and connecting with the floppy disk controller and floppy drives. The MUX card also has a cable that connects one disk drive with the power supply to get power to the MDQ (two models) external drive. The MUX card includes a cable long enough for AT&T 6300s and for other compatibles that have the floppy controller on the motherboard.

PC or XT owners may want to skip the MUX board and connect the drive directly to their floppy controller. Unfortunately, in designing the PC, IBM expected external floppy devices to supply their own power. Manzana provides a small PC board you can solder to the back of your floppy controller and connect to the power

CIRCLE 532 ON READER SERVICE CARD

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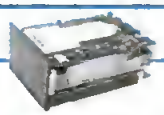

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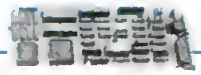

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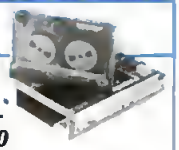

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CIRCLE 117 ON READER SERVICE CARD

supply. As solder jobs go, this is an easy one to accomplish.

If wielding hot irons is not for you, or if you have an old PC with a dinky 63.5-watt power supply, you should consider Manzana's MDP3A drive. It has its own power supply.

If you have room for a half-height floppy drive, Manzana's $249 MDl3 drive will slip rigllt in and connect just like a 5¼-inch floppy. Since it is an internal drive, it is not necessarily an option for everyone.

Any Manzana drive that does not use a MUX card will run under DOS 3.2's 3½-inch device driver as well as under Manzana's own software. For those who run DOS 2.1, Manzana's *3FIVE* software will run with IBM's drive. All of Manzana's products use Sony drives.

MICRO-Z CO.

Direc-Link

Direc-Link has the most DOS shell–like features of any of the tested products. Not surprising, since the product points out it is "From Micro-Z Company, Creators of *Direc-Tree*." Like *The Brooklyn Bridge* and *Lap-Link*, *Direc-Link* uses the serial ports of the two computers to transfer selected files at 115,200 bps.

Direc-Link transferred the contents of the DOS 3.2 distribution disk in just over 2 minutes, a performance comparable to the other 115,200 bps transfer products reviewed here. But before it would accept commands, *Direc-Link* also took an additional 2 minutes to read in the relatively simple directory structure of our hard disk. Users with large hard disks or many directories might have a longer wait.

The first thing you see when you use *Direc-Link* is a tree diagram of your current disk drive's directory structure. Using the ScrollLock key, you can select the tree diagram for the other computer and, by using the cursor keys, you can select the active directory on each machine.

PC MAGAZINE FACT FILE

Direc-Link
Micro-Z Co.
4 Santa Bella Rd.
Rolling Hills Estates, CA 90274
(213) 377-1640
List Price: $59.50
Requires: 64K RAM, serial port and cable.
In Short: A device driver–like product with a number of DOS shell features. Not copy protected.

CIRCLE **639** ON READER SERVICE CARD

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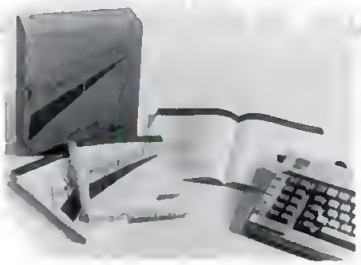
3



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Call (617)275-4439 and order XyWrite III ($395), or the demo disk ($7).

XYQUEST

XyQuest, Inc.
3 Loomis Street, Bedford, MA 01730

CIRCLE 518 ON READER SERVICE CARD

Copying files is a little bit backwards. First you select the destination directory and then you select the files you want to copy. You can select files by "pointing" at them with the cursor keys or by wildcard. *Direc-Link* also has a script facility that lets knowledgeable users automate transfers that must be made regularly.

If you like DOS shells, and if you like *Direc-Tree*, you will like *Direc-Link*.

PROSPECT RESEARCH CORP.

PC Trans

Prospect Research Corp.'s *PC Trans* is slow and difficult to use. That and a dearth of documentation make it worth skipping and pocketing the $165 it would have cost you.

PC Trans comes in a 1978 Baggie-style package (a plastic bag with cardboard stiffener and a fluorescent orange header). Inside you find one page of documentation, a cable, AT serial port adapter, and 3½-inch and 5¼-inch disks.

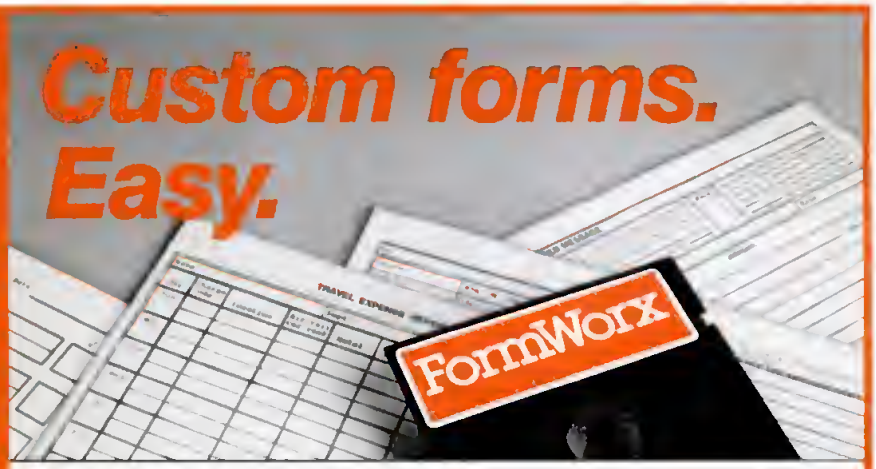
PC MAGAZINE FACT FILE

PC Trans
Prospect Research Corp.
100 Prospect St.
New Haven, CT 06511
(203) 624-6765
List Price: $165
Requires: One serial port, one floppy disk drive.
In Short: A substandard transfer utility that can't compare with other, more-sophisticated products. Not copy protected.

CIRCLE 634 ON READER SERVICE CARD

At first glance, *PC Trans* looks like another device driver product such as *The Brooklyn Bridge* or *Paranet*. On examining the "documentation," we see that you specify the files to be sent with the command line parameter, SEND, and FILENAME on the transmitting machine, and

■ *PC Trans* was the slowest product PC Labs tested. It took nearly 15 minutes to transfer the DOS 3.2 distribution disk from one machine to the other.



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Signature _____ Date _____

Name _____

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1365 Massachusetts Ave., Arlington, MA 02174

CIRCLE 174 ON READER SERVICE CARD

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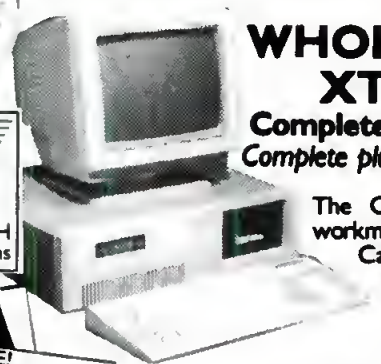

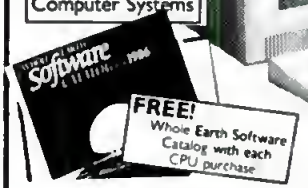

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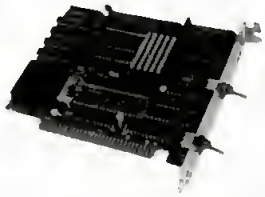

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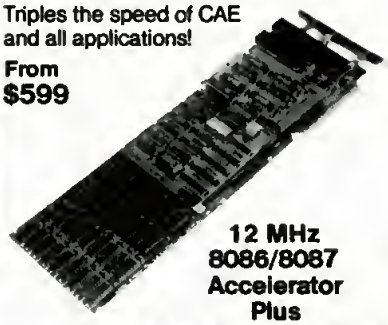

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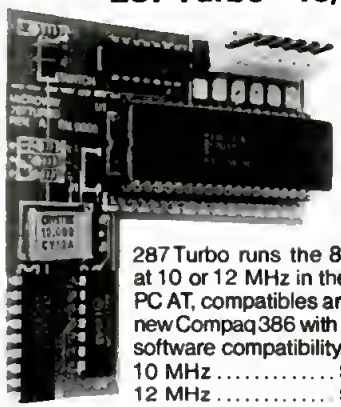

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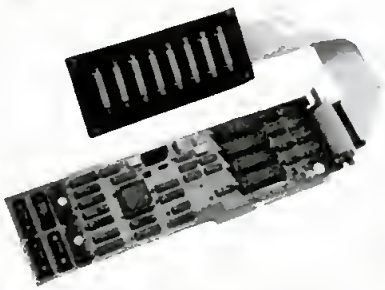

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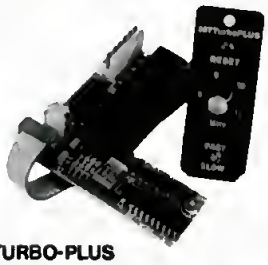

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you specify the files to be received by using the parameter RECEIVE and the drive on which they will be saved on the receiving computer. All this seems awkward in comparison to other products.

PC Trans was the slowest product PC Labs tested. It took nearly 15 minutes to transfer the DOS 3.2 distribution disk from one machine to the other.

PC Trans reminded me of the days when computers had 24K bytes and CP/M was king. It requires a lot of operator skill and it offers very little help. Fortunately those days are behind us. *PC Trans* is a 1978-type product, and in 1987 it just doesn't measure up.

RUPP BROTHERS

Fastwire Plus

Direc-Link and *Lap-Link* have DOS shell–like interfaces built in. *The Brooklyn Bridge* and *PC Liaison* use DOS prompt or other shells. *Fastwire Plus* from Rupp Brothers is another device driver kit, but it takes all its instructions from the command line. This user interface requires more expertise than others. But the command line interface does make it easy to write batch files if there are some transfers that should be made periodically.

Like *Lap-Link* and *The Brooklyn Bridge*, *Fastwire* transfers data at 115,200 bps via the serial ports, though *Fastwire* seems to run a little slower. While *Lap-Link* transferred the entire contents of the disk in 2 minutes and 34 seconds, *Fastwire*

PC MAGAZINE FACT FILE

Fastwire Plus
Rupp Brothers
P.O. Drawer J, Lenox Hill Sta.
New York, NY 10021
(212) 517-7775
List Price: $129
Requires: 128K RAM, one floppy disk drive, DOS 2.0 or later, null modem serial cable, IBM asynchronous adapter (serial card) or equivalent.
In Short: A device driver that takes instructions from the command line. Useful if you can write batch files. Not copy protected.

CIRCLE 630 ON READER SERVICE CARD

FINALLY!

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* March 10, 1987 issue, page 278.
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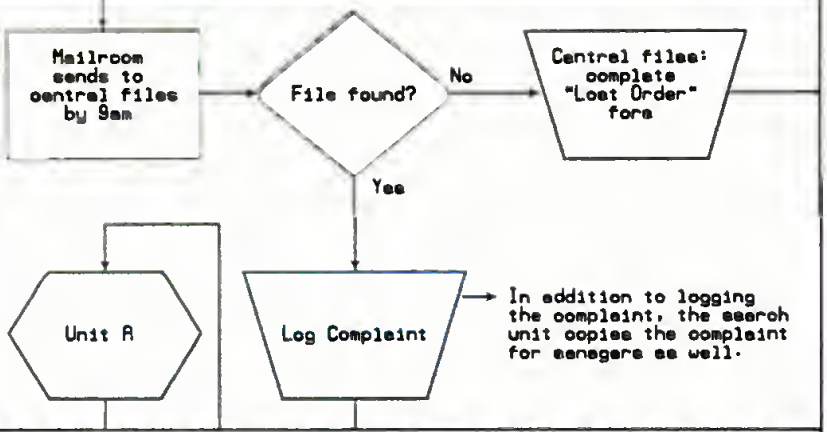

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Fastwire also has a unique 176,000-bps mode that uses two cables and both the COM1 and COM2 ports. This feature sounds interesting, but most laptops have just one serial port and really can't use it. It may come in handy, however, for people upgrading from XTs to ATs.

Fastwire may be useful if someone is available to write the batch files and if the same types of transfers are made regularly. If that doesn't describe you, try *The Brooklyn Bridge* or *Lap-Link*.

TIGERTRONICS INC.

Tigertronic 853W

Tigertronics is a mail-order supplier that buys top-quality Sony 3½-inch floppy disk drives and sells them for internal use in a PC for $159.95.

In reality, 3½-inch internal drives are all pretty much the same. The manufacturer buys a drive from Alps, Sony, Toshiba, or Matsushita, mounts it to a bracket so it fits the 5¼-inch half-height form, adds

PC MAGAZINE FACT FILE

Tigertronics 853W
Tigertronics Inc.
2734-C Johnson Dr.
P.O. Box 3717
Ventura, CA 93006
(805) 658-7466
List Price: $159.95
In Short: An internal 1-Mbyte 3½-inch disk drive that has a cable that is rather flimsy and a connector that is not gold-plated; however, there is good value here for the price.

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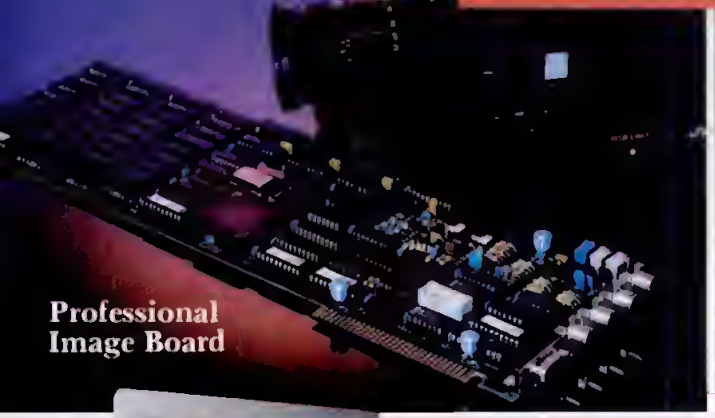

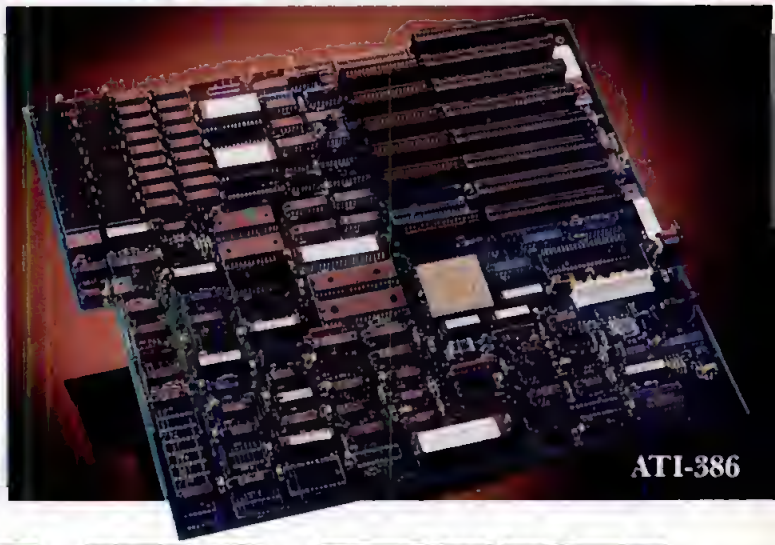

ADVANCE TO THE NEXT LEVEL

ATI-386

The ATI-386 AT board is a high-performance system board that provides the primary elements for building advanced personal computers. The board is functionally compatible with the system board in the IBM AT. However, it contains an 80386 microprocessor, 32-bit access to data and other features that give it over twice the performance of an 8MHz IBM AT.

Other features include downward compatibility with IBM 8 MHz AT, one MByte 32-bit on-board memory expandable to 16 MByte, a socket for the Intel 80387 math co-processor and more.

ATI-386-64

The ATI-386/64 Board features the same specifications as the ATI-386 AT board as well as on-board 64 KByte cache memory, cacheable to a full 16 MByte memory space to achieve nearly zero-wait state operation at full speed.

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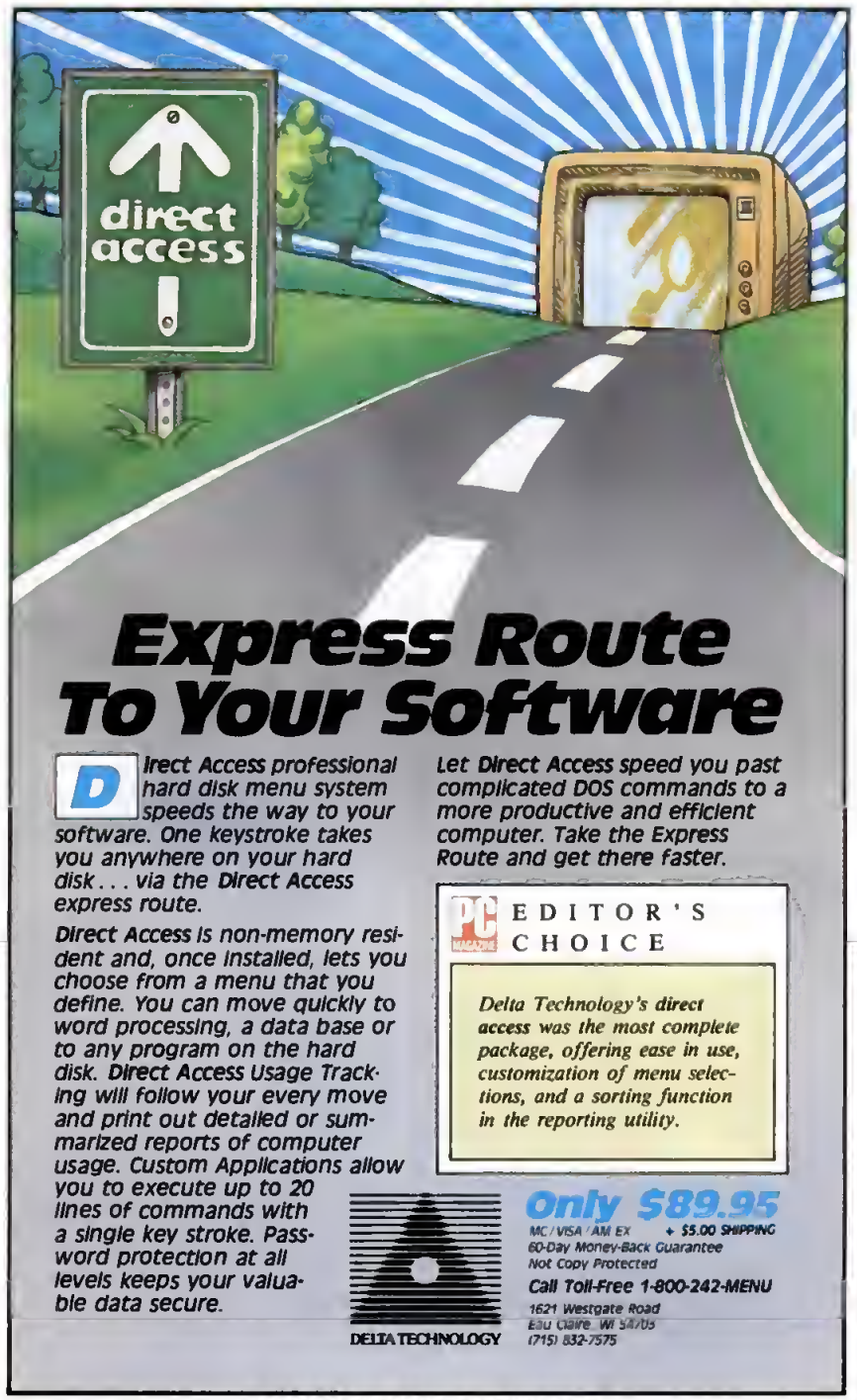
some kind of adapter so the drive can accept standard data and power connectors, and puts it in a box. Since IBM supplies the software as part of DOS 3.2, you don't really have to do any R&D to get it to run.

The Tigertronics product isn't perfect: the adapter cables are rather flimsy, and the data connector is not gold-plated. Those are minor matters, however; the Tigertronics drive provides good value.



CIRCLE 256 ON READER SERVICE CARD

TOSHIBA AMERICA INC.

Toshiba Floppy Link

Toshiba America's $199 Floppy Link lets you use one of your PC's floppy disk drives as an external 5¼-inch drive by connecting it to your Toshiba laptop's floppy controller. However, this means all transfers must be made from floppies. The approach eliminates the need for additional drives, but, like any transfer done from 5¼-inch floppies, it can be unwieldy for large transfers. Floppy Link works only with Toshiba's T1100 Plus and T3100 laptops.

Floppy Link provides an expansion card to go in your PC and cables to connect the card to your floppy controller and floppy drives. You use another cable to connect the floppy port of your Toshiba laptop to the card. You select which PC drive to use and which drive on the laptop it replaces by setting switches on the card. The PC's B: drive could, for example, be the Toshiba's A: drive. If you make the 5¼-inch floppy your A: drive, most keydisk copy-protected software will run perfectly well. Of course, since you have the PC, you wouldn't need to run that software on your laptop while it's connected anyway.

■ Toshiba's Floppy Link provides an expansion card to go in your PC and cables to connect the card to your floppy controller and floppy drives.

Floppy Link provides cables for PCs, XTs, and ATs. Users of compatibles such as the AT&T 6300 or Wyse PC, whose floppy controller is on the motherboard, may require longer, custom-made cables with nonstandard pin assignments.

Toshiba has succeeded in keeping the cost down by eliminating the need to buy

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PROPOSAL

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CIRCLE 536 ON READER SERVICE CARD

■ Toshiba has succeeded in keeping the cost down by eliminating the need to buy another drive.

another drive, but it still has only a floppy on the laptop. Even though the two machines are connected, all transfers must be made via floppies. This can be awkward when you are trying to transfer a lot of data. It becomes almost unthinkable if you have files larger than 360K bytes.

Another disadvantage is that the Toshiba laptops have one port for either the external drive or parallel printer, and you have to disconnect your printer each time you want to use Floppy Link. You can, however, avoid plugging and unplugging the drive and printer by purchasing a switch box for about $50. The Toshiba also disables one of the internal drives and addresses an external drive as A: or B:. On a T1100 Plus all you have is one 3½-inch drive and one 5¼-inch drive.

PC MAGAZINE FACT FILE

Toshiba America Inc.
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680
(714) 541-1062

Toshiba Floppy Link
List Price: $199
Requires: One floppy disk drive, one expansion slot
In Short: A card and cabling combination that connects PCs and laptops but does not allow hard-disk-to-hard-disk transfers.
CIRCLE 643 ON READER SERVICE CARD

Toshiba ND354A
List Price: $150
Requires: DOS 3.2.
In Short: An internal 3½-inch disk drive installation kit that is easy to install and comes with every faceplate and bracket you could possibly need.
CIRCLE 644 ON READER SERVICE CARD

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Christopher O'Malley
PERSONAL COMPUTING, April '86

PC MAGAZINE "Because copy protection can interfere with the ability to back up a hard disk, business-oriented users may prefer programs like TranSec's UNlock series."
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PC MAGAZINE, May 27, 1986

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CIRCLE 481 ON READER SERVICE CARD

It was also slow. *The Brooklyn Bridge*, which transferred the disk contents in 1 minute and 55 seconds, not only is faster than *Floppy Link*, which transferred the data in 3 minutes and 2 seconds, but it also allows hard-disk-to-hard-disk-transfers for the T3100.

TOSHIBA AMERICA INC.

Toshiba ND354A

For $150, Toshiba's internal 3½-inch disk drive gives you every faceplate, eject button, and bracket you could ever need. This kit allows the 3½-inch drive to fit 3½-inch and 5¼-inch full-height drive slots. It includes color-coordinated faceplates and eject buttons in PC black and AT gray along with both AT and Compaq mounting slides.

You install this drive by selecting your choice of brackets, slides, faceplate, and eject button and screwing them together.

■ *Lap-Link* is the most convenient transfer product for the occasional user. It does not require changes to CONFIG.SYS or AUTOEXEC.BAT files.

After that, it goes in as if it were just another 5¼-inch drive. Expect to spend 20 minutes or so, compared to the 5 minutes it takes to install the preassembled Manzana drive. Still, all but the most fumble-fingered should be able to handle it. The manual is clear and the only tool required is a screwdriver.

Toshiba assumes you will use DOS 3.2 to run the drive. No software is provided and, unlike Manzana, you cannot use it with DOS 2.1. The Tigertronics or the J&M are more expensive ($159.95 and $225, respectively), but both are easier to assemble.

TRAVELING SOFTWARE INC.

Lap-Link

Traveling Software's *Lap-Link* is the most convenient transfer product for the occasional user. Like *The Brooklyn Bridge*, it transfers data at 115,200 bps. However, it does not require changes to the CONFIG.SYS or AUTOEXEC.BAT files on either machine as *The Brooklyn Bridge* does.

All you need to do to run *Lap-Link* is

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CIRCLE 330 ON READER SERVICE CARD

EDITOR'S CHOICE

FACT FILE

Lap-Link
Traveling Software Inc.
North Creek
Corporate Ctr.
19310 North Creek
Pkwy.
Bothell, WA 98011
(800) 343-8080
(206) 483-8088
List Price: $129.95
Requires: 128K RAM on laptop, 100K RAM on desktop, DOS 2.0 or later
In Short: Split screen shows contents of directories in both machines. Faster than *The Brooklyn Bridge* and competitively priced. Not copy protected.

CIRCLE 637 ON READER SERVICE CARD

connect the cables (which include DB-9 and DB-25 connectors at both ends to connect to any laptop and/or PC model) and type LL on both machines. But the 3½-inch disk and 5¼-inch disks that are produced are serialized, and you must be careful not to mix them up or the machines will not talk to one another.

Lap-Link's main display is a split screen showing the contents of the current directory of both computers. From this screen you can copy files (including wildcard and multiple wildcard copies), log on to a new directory on either machine, and delete or rename files on either machine.

You can also select the Turbo mode that reduces the overhead on the line by increasing the block size of the data transfer. In Turbo mode, *Lap-Link* transfers data even faster than *The Brooklyn Bridge*. It seemingly sets a record for the fastest serial transfer on a PC. It certainly did in our tests, and, at $129.95, it was one of the best buys.

WHITE CRANE SYSTEMS

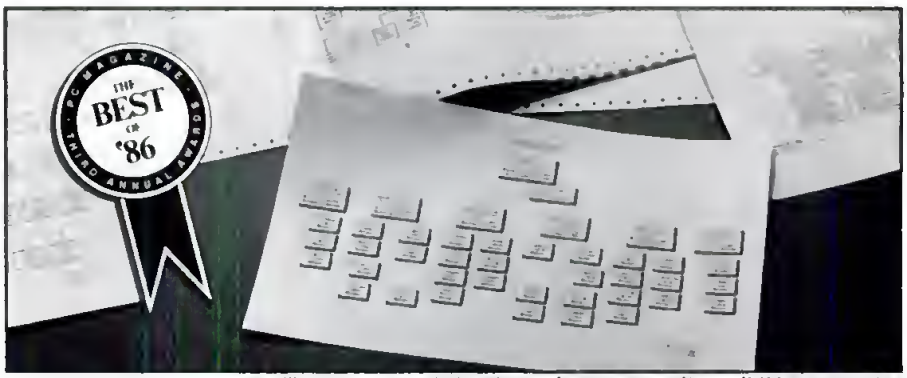
The Brooklyn Bridge

Imagine walking into your dealer and having him try to sell you the Brooklyn Bridge. In this case, the old joke is no joke. White Crane Systems' *The Brooklyn Bridge* sells for $129.95. It's a steal.

It's almost as fast as an external 3½-inch disk drive. It allows you to use your favorite DOS shell for selective file transfers and it even lets you use your PC's peripherals from your laptop.

Like *PC Liaison*, *The Brooklyn Bridge* is a device driver that connects your PC to your laptop via their respective serial ports. It installs as a device driver on the "master" machine and as an applications program on the "slave." You can set up either machine as the master.

Unlike *PC Liaison*, *The Brooklyn*



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CIRCLE 474 ON READER SERVICE CARD

■ DATA TRANSFER

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

The Brooklyn Bridge
White Crane Systems
6889 Peachtree Ind. Blvd.
Norcross, GA 30092
(404) 454-7911
List Price: $129.95
Requires: One serial port.
In Short: An exceptionally fast and functional transfer utility. Highly recommended. Not copy protected.

CIRCLE 641 ON READER SERVICE CARD

Bridge uses a little-known mode of the PC's serial port which was first used in zero-slot LANs like LANLink to launch transmission speeds from the normal 9,600 bits per second into the hyperspace of 115,000 bps. White Crane claims this is faster than the data rate for floppy disks.

■ *The Brooklyn Bridge* is the perfect solution for people who use a laptop almost exclusively as a portable machine that travels from PC to PC. It is terrific!

The Brooklyn Bridge is the perfect solution for people who use a laptop almost exclusively as a portable machine that travels from PC to PC. It is terrific!

ZENITH DATA SYSTEMS

Zenith 5¼-Inch Disk Drive

If you've decided that a 5¼-inch floppy drive for your laptop is for you, then you really don't have a whole lot of choice as to brand. Unlike 3½-inch drives for the PC,

FACT FILE

Zenith 5¼-Inch Disk Drive
Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8949
List Price: $399
In Short: An external 5¼-inch floppy disk drive that, though slow, is easy to set up and easy to use.

CIRCLE 642 ON READER SERVICE CARD

5¼-inch drives don't have third-party suppliers like Manzana or Tigertronics. If you want a 5¼-inch drive, you have to buy it from the same people you bought your computer from.

If that company happens to be Zenith Data Systems, you will receive a simple-to-use, well-made add-on disk drive. Installing this drive is a matter of connecting the power and the supplied data cable. The drive is then addressed by Zenith DOS as drive C:. No other setup is required to get the drive up and running.

Neither 5¼-inch nor 3½-inch disk drives have ever been called blindingly fast. So it comes as no surprise that this drive is one of the slowest transfer techniques reviewed here. It is also one of the most expensive to implement. The drive costs $399.

Zenith's drive is a quality product, but an external 5¼-inch drive for a laptop is really best suited for the person who uses the laptop as his or her main computer. PC

Howard Marks is an independent systems consultant and free-lance writer based in New Jersey.

EDITOR'S CHOICE

- **The Brooklyn Bridge**
- **Lap-Link**

White Crane Systems' The Brooklyn Bridge *and Traveling Software's* Lap-Link *are fast, functional, and competitively priced. Each sells for $129.95.* The Brooklyn Bridge *may be the most accessible for many users. It requires only a serial port. But* Lap-Link *with memory requirements of 128K bytes of RAM on the laptop and 100K RAM on the desktop, brings an added touch of class by showing the contents of both computers' directories on a split screen.*

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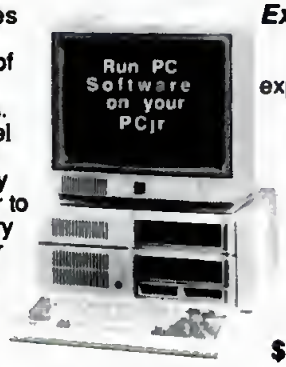

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■ PC LAB NOTES: MOUSE SOFTWARE ■ JEFF PROSISE

MOUSE SOFTWARE: SEE HOW THEY RUN

Here's a guide through the maze of mouse programming, together with a utility that lets you use the little varmints even with programs not designed to support them.

Mocking mice and other Apple appurtenances has long been easier than telling jokes about New Jersey, but there are times when even the most hardened PC devotee will admit that the keyboard alone just can't hack it. Microsoft's QuickBASIC—arguably one of today's three best new software values—will certainly run from the keyboard, but it really sits up and says "cheese" only when you use it with a mouse. Painting applications, where mouse devices are as essential as the software itself, are to the graphics world what word processors are to writers. You have but to put one of these drawing utilities on an EGA-equipped PC to recognize their attraction and usefulness. And with *Windows* being built right into IBM's new operating system, it's clear that the best way to manage the circus of multitasking operations for 286 and 386 machines is through a visual interface, the natural habitat of the mouse.

Fortunately for PC users, you can teach an old dog new tricks. All you need to supercharge your machine with a mouse is the mouse hardware and the resident device driver that comes with it. From the user's standpoint, there's not much that can be written about a mouse that can't be gleaned from a few minutes of hands-on experience. In some applications, like *Microsoft Paintbrush* (which is included with every purchase of a Microsoft Mouse), the mouse becomes a natural extension of your own hand. In others, like QuickBASIC, it's used to open menus effortlessly, select blocks of text, page through a file, and so on.

That's not to say that there aren't drawbacks to having a mouse. While it's nice to be able to move a cursor from one corner of the screen to another with a single click of a button, it's maddening to have to leave the keyboard to move it left or right a single character cell. That's my biggest gripe with some of the Macintosh word processors. It's a classic example of how excess can ruin a good thing.

But the most obvious problem with owning a mouse today is that so few major applications take advantage of it. At the end of this article, I'll present a general-purpose utility you can use to make your mouse move around the screen and page up and down in programs that were not designed with mice in mind.

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BEHIND THE SCENES From the programmer's point of view, the mouse represents a new frontier of code design and philosophy. The driver, a .SYS or .COM file, is a collection of routines that translate mouse actions into events that can be trapped by a running application program. It also provides a BIOS-like programming interface. Unfortunately, however, not all mice operate identically. Before you can design either mouse add-on utilities or design an application for use with a mouse, you must first choose which mouse and driver to target.

The Microsoft Mouse is a likely choice for a couple of reasons. First, Microsoft is in the unique position of supplying mouse hardware and software as well as a host of hot-selling PC programs in a variety of categories. Second, that company's mouse driver is full-featured (save that it uses two buttons instead of three) and is constantly undergoing internal review for adaptation to the latest industry requirements. Indeed, many other mouse drivers, including those supplied with Summagraphics' SummaMouse and LogiTech's LogiMouse, provide an emulation of the Microsoft version.

I don't suggest, then, that other mice are necessarily inferior. Your own choice may be determined by exterior features such as the number of buttons, whether the mouse is of the mechanical or optical vari-

Table 1: The Microsoft Mouse Drive Function Calls

A complete list of programming functions supplied through the Microsoft mouse driver is as follows. Only the function names are listed; for detailed descriptions of input and output values, refer to the *Microsoft Mouse Programmer's Reference Guide* and to the body of this article.

0	Reset driver and read status
1	Show mouse cursor
2	Hide mouse cursor
3	Return position and button status
4	Position mouse cursor
5	Return button press data
6	Return button release data
7	Define horizontal cursor range
8	Define vertical cursor range
9	Define graphics cursor
10	Define text cursor
11	Read motion counters
12	Define interrupt subroutine parameters
13	Light pen emulation on
14	Light pen emulation off
15	Define mickey/pixel ratio
16	Define screen region for updating
19	Define double-speed threshold
20	Exchange interrupt subroutines
21	Return driver storage requirements
22	Save driver state
23	Restore driver state
29	Define display page number
30	Return display page number

In addition, the following functions are appended to interrupt 10h and implemented as the EGA Register Interface Library:

F0	Read one register
F1	Write one register
F2	Read consecutive register range
F3	Write consecutive register range
F4	Read non-consecutive register set
F5	Write non-consecutive register set
F6	Revert to default register values
F7	Define default register values
FA	Get driver status

ety, or the bundled software. But designing around the Microsoft Mouse ensures that the programming principles and means discussed here will apply to a broader market. [*For a review of a number of competing mouse products, see Phil Wiswell's article, "A Pocketful of Mice,"* PC Magazine, *Volume 6 Number 2. The reviews indicate which products are Microsoft-compatible.—Ed.*]

THE MOUSE DRIVER All communication between an applications program and a mouse is handled through the mouse driver. The driver is a collection of BIOS-like routines that are installed in memory just like a resident utility. The routines can be accessed from nearly any language, be it a low-level one like assembly, high-level ones like BASIC (both compiled and interpreted) and Pascal, or one like C that falls somewhere in between. The Microsoft Mouse driver is rather sophisticated, providing functions to do almost anything from checking the current mouse position to establishing an interrupt subroutine to be given control automatically when any one of a set of user-prescribed actions is taken with the mouse. The various function calls included in the Microsoft driver are documented in the *Microsoft Mouse Programmer's Reference Guide*. Unfortunately, this thorough and well-written technical manual (which costs $25) is available only to purchasers of a Microsoft Mouse. Since much of the material is generically applicable, however, I'll cover the most basic functions here.

The mouse software boasts 24 functions that provide underground hooks to the mouse. Oddly enough, they're numbered 0–16, 19–23, 29, and 30, and a complete list is shown in Table 1. Even sticking to a subset of the 24 function calls you can write some pretty powerful standalone and add-on applications.

The mouse function calls are accessed in assembly language through interrupt 51, a previously unused interrupt whose vector the mouse driver claims as its own. The AX, BX, CX, DX, and sometimes ES registers are generally used for input and by functions that return values to the calling routine. AX always specifies the function number, just as AH does in calls to the BIOS.

THE MOUSE CURSORS Functions 1, 2, 9, and 10 all concern the shape and appearance of the mouse cursor. The mouse cursor is an object that tracks the on-screen movements of the mouse just as the regular blinking cursor on the PC follows the lead of the four arrow keys. There are three important points to understand about the mouse cursor.

First, as every programmer knows, movement of the traditional cursor isn't necessarily tied to the arrow keys. What moves it and if it moves at all is entirely up to the application. But the mouse cursor is permanently linked to motion on the part of the mouse and, what's more, the driver takes care of shuffling the cursor around the display with no effort or attention required of the running application. Second, the driver changes the cursor position even when the cursor is not visible. Third, there are three different types of mouse cursors: the graphics cursor, the software text cursor, and the hardware text cursor.

The graphics cursor can only be used while the PC is running in graphics mode. A mouse application running in text mode, however, can choose between the software text cursor and the hardware text cursor. The latter is nothing more than the normal blinking cursor maintained by the machine's video hardware. The former is similar to the block cursor employed by the BIOS when working in graphics mode. And the graphics cursor, which can take on virtually any shape, is a user-definable entity that the driver alternately draws and erases as it moves it across the screen.

Functions 1 and 2 are used to show and hide the mouse cursor. The following two lines of code are sufficient to display it:

```
MOV AX,1
INT 51
```

Conversely, setting AX to 2 before executing the interrupt hides the cursor. The cursor responds to both functions regardless of its current type or of the video mode. Unlike the BIOS routines that manipulate the traditional hardware cursor, functions 1 and 2 actually increment and decrement an internal flag that determines whether the cursor is visible at any given time. A value of 0 causes it to be displayed; any other value prevents it from being seen. If, for example, the cursor was visible and you invoked the hide cursor function twice in a row, you would have to call function 1 twice to make it appear again. Although successive calls to function 2 force the internal flag to go more and more negative, the flag's value cannot exceed zero. Thus, a call to function 1 with the cursor already

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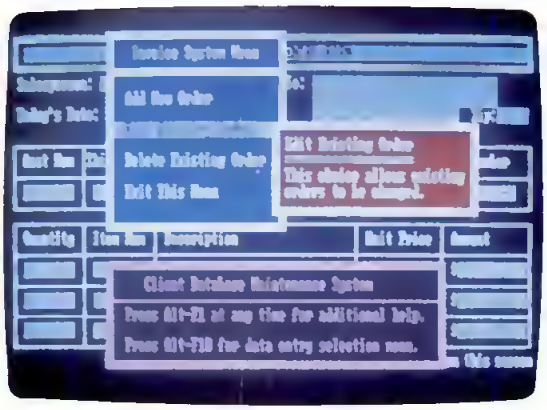

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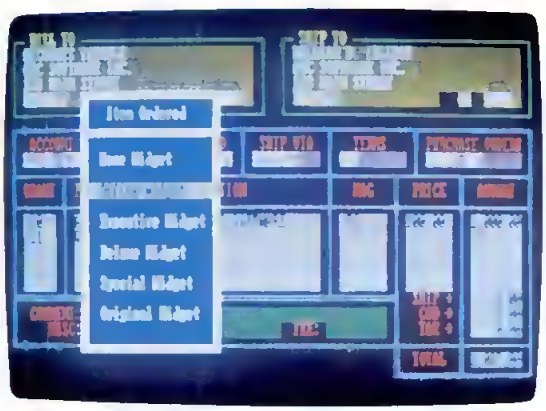

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displayed will not cause it to disappear.

Functions 9 and 10 are for setting the appearance of the mouse cursor. Function 9 defines the graphics cursor and expects three parameters to be passed to it. The first, in the ES:DX register pair, is the address of the screen and cursor mask arrays. The cursor mask array immediately follows the screen mask array in memory; the two arrays work together to define the shape and color of the graphics cursor. Each is an array of 16 words. In the location at which the cursor is to appear, the mouse driver first logically ANDs video memory with the contents of the screen mask, then performs an XOR with the cursor mask. Any pixel on the screen that corresponds to a 0 bit in the screen mask is turned off; then, any pixel paired against a 1 bit in the cursor mask is inverted. In less technical terms, the whole process simply makes sure that the cursor contrasts whatever background it appears against.

THE MASK OF ZERO The normal practice is to set all bits in the screen mask to 1 (resulting in 16 values of FFFFh), then to prescribe the cursor shape in the cursor mask array by setting the desired pixels to 1 amid a field of 0's. Since a picture is worth a thousand words, the following cursor mask array (one of several samples listed in the *Programmer's Reference* manual) is the one that creates the familiar pointing arrow:

```
8000h     1000000000000000
E000h     1110000000000000
F800h     1111100000000000
FE00h     1111111000000000
D800h     1101100000000000
0C00h     0000110000000000
0600h     0000011000000000
0300h     0000001100000000
0000h     0000000000000000
0000h     0000000000000000
0000h     0000000000000000
0000h     0000000000000000
0000h     0000000000000000
0000h     0000000000000000
0000h     0000000000000000
0000h     0000000000000000
```

If you stare at the page for a moment, you'll see the shape of the arrow defined by the 1's. Saying that setting an array value to 1 or 0 to turn a pixel on or off is an oversimplification in graphics modes that permit more than one color, especially in high-resolution EGA modes that store color information in separate bit planes. But the principles are the same. Writing mouse applications that employ special EGA graphics modes are a topic in themselves, as we'll see a bit later.

The second and third parameters passed to function 9 are the horizontal and vertical coordinates of the cursor hot spot. The hot spot is the pixel in the cursor block that determines the cursor address. The horizontal coordinate is entered in BX, the vertical in CX. A cursor shaped like the one above, for example, would probably use the tip of the arrow as its hot spot. Coordinates are relative to the upper left corner of the block. The following lines of code would define a graphics cursor for a mouse application and set the upper left corner (location 0,0) of the cursor block as the hot spot. It's assumed that ES points to the segment that contains the screen and cursor mask arrays:

```
MOV AX,9
MOV BX,Ø
MOV CX,Ø
MOV DX,OFFSET MASK_ARRAYS
INT 51
```

Function 10 controls the appearance of the mouse text cursor. Setting BX to 0 before the call selects the software text cursor, and setting it to 1 selects the hardware text cursor. What's passed in CX and DX depends upon which cursor is being invoked. For the hardware cursor, the two registers represent its starting and ending scan lines. This is directly analogous to function 2 of the BIOS video interrupt 10h. For the software cursor, CX and DX pass the values of a screen and cursor mask, respectively, similar in function to the masks of the same names associated with the graphics cursor. Each mask is one word in length, corresponding bit for bit with the 16 bits that comprise a character/attribute pair in video memory. The word representing the character at the current cursor location is first ANDed with the screen mask, then XORed with the cursor mask. The data in the lower half of each register (CL and DL) operate on the character itself; the upper 8 bits comprise its attribute byte. Programmers typically define a software text cursor by leaving the ASCII code of the character unaltered, but inverting its foreground and background colors to produce a reverse field effect. The following code example accomplishes this:

```
MOV AX,1Ø
MOV BX,Ø
MOV CX,77FFh
MOV DX,77ØØh
INT 51
```

The effect of logically ANDing the screen mask with the character attribute pair is to turn off the blink and intensity bits but leave everything else intact. The cursor mask follows suit in leaving the character code untouched, but flips the binary values that determine the foreground and background colors. When the mouse cursor is moved, the original contents of the character and attribute are restored before the cursor is redrawn at another location.

TRACKING MOUSE POSITION An essential job of the device driver is to track the mouse at all times and make the location information available to a requesting application. Exactly how the mouse software does this is outlined in the sidebar "Tracking the Mouse." Functions 3, 4, 7, and 8 provide the means for an application to interrogate the driver.

A call to function 3 returns two kinds of information: the status of both mouse buttons and the current mouse cursor position. Button status is represented by the first two bits of the value passed back in the BX register. Bit 0 corresponds to the left button, bit 1 to the right one. A set bit indicates the corresponding button is pressed. The CX and DX registers on return hold the horizontal and vertical coordinates, respective-

■ Each mask is one word in length, corresponding bit for bit with the 16 bits that comprise a character/attribute pair.

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TRACKING THE MOUSE

The Microsoft Mouse comes in two flavors: the bus version, which comes complete with its own board to be installed in an empty slot, and the serial mouse, which plugs directly into a serial port. They're perfectly identical on the outside, and handle exactly the same way in use. But a closer look reveals that the resemblance is only superficial.

The difference is in the way they communicate with the mouse driver. The serial unit works much like the IBM keyboard, which contains its own microprocessor to monitor keyboard activity and disturbs the CPU only when a key is pressed or released. The serial mouse generates an interrupt that's picked up by the driver whenever a button is pressed or released or when the mouse is moved. A 1200-bps communication rate is utilized. Given the structure of the data sent from the hardware to the software, 1200-bps means that the mouse driver can trap up to about 40 events per second, which is adequate for all but the most demanding applications.

The bus mouse, on the other hand, doesn't generate interrupts of its own. The CPU must poll it at regular intervals to ensure that any and all events are trapped. Ostensibly, this means that the bus mouse requires a great deal more overhead than its serial counterpart, but it does have one significant advantage: the rate at which it is polled is programmable. Polling can occur at rates of 30, 50, 100, or 200 Hz, and the figure is user-selectable via a command line switch. The higher communication rates are desirable in applications like freehand drawing programs.

The functions provided as the programming interface are identical for the bus and serial mouse. An application written for one should run flawlessly on the other.—**Jeff Prosise**

ly, of the current cursor position. The range of these coordinates and the values they may take on depend upon the screen mode active at the time the call is made.

The number of addressable pixels on the screen at any given time is determined by the video mode. A PC equipped with an EGA display adapter and an enhanced color display is capable of entering any one of 10 different modes. Several different graphic resolutions (the number of pixels that can be addressed horizontally and vertically) are supported, and in standard text modes pixels are accessible only as clusters that are controlled by character-generating circuitry.

In order to achieve some degree of consistency in assigning mouse coordinates, the mouse driver thinks in terms of a virtual screen. A comparison between virtual and physical screen resolutions is presented in Figure 1. Any report of mouse position returned by the mouse software is given in terms of the virtual screen appropriate for the mode. Mode 6, for example, a two-color medium-resolution graphics mode offering a 640 by 200 matrix of pixels, uses a 640 by 200 virtual screen. Since the pixels on the physical screen match the pixels on the virtual screen, it's easy to see how they correspond. But it's not immediately obvious in modes like 4 and 5, where the virtual screen retains its 640 by 200 arrangement but the physical display illuminates a 320 by 200 array of pixels.

The mouse driver compensates for the limited horizontal resolution of modes 4 and 5 by assigning only even-numbered horizontal coordinates for the mouse cursor position. Moving the mouse slightly to the right from a pixel with horizontal coordinate 98 will change its value to 100. Text modes are handled in a similar way. Since a character cell in 80-column text modes 2 and 3 is composed of an 8 by 8 virtual array, the mouse cursor position is reported in values that are multiples of 8. If the mouse cursor is located in the upper left-hand corner of the screen, function 3 will return 0's in both CX and DX. If it is moved one row down, the mouse cursor is assigned the vertical coordinate 8. The 40-column text modes employ a 16 by 8 cell size and, as a result, report the horizontal cursor position in multiples of 16 and the vertical in multiples of 8.

Function 4 sets the mouse cursor position to the location dictated by the application. Input coordinates must conform to the rules and limitations imposed by the correspondence between the screen mode and virtual screen. The following program lines would place the cursor in the center of the screen assuming the machine is running in either of the 80-column video modes 2 or 3:

```
MOV AX,4
MOV CX,32Ø
MOV DX,96
INT 51
```

Functions 7 and 8 serve to limit the space in which the mouse cursor may roam. Function 7 defines the minimum and maximum horizontal cursor position, while function 8 sets the same parameters for the vertical position. In both, the value representing the minimum is passed in CX and the maximum in DX. After a call to one of

Mode	Description	Virtual Resolution	Physical Resolution
0	40-col text	640 X 200	16 X 8 cell size
1	40-col text	640 X 200	16 X 8 cell size
2	80-col text	640 X 200	8 X 8 cell size
3	80-col text	640 X 200	8 X 8 cell size
4	graphics	640 X 200	320 X 200
5	graphics	640 X 200	320 X 200
6	graphics	640 X 200	640 X 200
7	80-col text	640 X 200	8 X 8 cell size
13	graphics	640 X 200	320 X 200
14	graphics	640 X 200	640 X 200
15	graphics	640 X 350	640 X 350
16	graphics	640 X 350	640 X 350

Figure 1: *Virtual screen versus physical screen resolutions by mode.*

■ PC LAB NOTES

THE MOUSE MENU LANGUAGE

There's an easy way to integrate a Microsoft Mouse into existing applications that don't explicitly support it. The Mouse Menu Language (MML) is a high-level compiled language comprising 13 commands that are designed specifically for the mouse. The compiler, a file named MAKEMENU.EXE supplied on the Tools Disk that accompanies the *Programmer's Reference*, produces a memory-resident utility that operates behind the scenes waiting for a predetermined signal from the mouse to spring into action. The signal can be a button press, a dual button press, or a mouse movement. Once it has control, the MML program can pop up one of two styles of menu windows or simulate keypresses by inserting keycodes into the keyboard buffer.

The following few lines of MML code illustrate a simple but complete mouse program that is the functional equivalent of the MOUSEKEY.COM program presented in this column. The difference is striking: the MOUSEKEY assembly source listing is many times the length of the MML utility.

```
BEGIN lfb,rtb,,left,right,up,down
lfb:      TYPE 0,73
rtb:      TYPE 0,81
left:     TYPE 0,75
right:    TYPE 0,77
up:       TYPE 0,72
down:     TYPE 0,80
```

The only two MML commands used here, BEGIN and TYPE, are shown in uppercase. The BEGIN statement tells the program where to go when a button is pressed or when the mouse is moved. The label lfb, for example, is vectored to when the left mouse button is pressed. The single executable line that follows it stuffs the keycode for the PgUp key (ASCII code 0, scan code 73) into the keyboard buffer. The other codes should look as familiar as those for PgDn and the four cursor keys. The pair of commas after BEGIN lfb rtb indicates that no action is to be taken when both buttons are pressed simultaneously.

You can see a better example of the MML in action by trying any of the three prewritten add-ons included with the initial purchase of the mouse. One supplements Lotus's *1-2-3* and illustrates the extent to which the MML programmer can dress up an existing application. The language itself is reasonably easy to learn and a whole lot of fun to use. The documentation, included in the *Programmer's Reference*, is very good. Anyone familiar with a high-level language will have no trouble.

One superbly useful feature is the language's MATCH statement. With it a program can decide between courses of action based on the presence (or absence) of a text string anywhere on-screen. If you were writing a program to enhance *1-2-3*, you might check the status box in the upper right corner of the screen before deciding which window to pop up. Or you could use MATCH to invoke context-sensitive help windows.

In fairness to other mice, Microsoft's menu language is by no means unique. Most every mouse includes an equivalent—without the bother of sending in a postpurchase coupon and $25. Some, like the one with the Logimouse, duplicate the Microsoft version; others sport their own implementation. Microsoft is the only manufacturer I know of that charges extra for it.—**Jeff Prosise**

these functions, cursor movement is restricted to the specified area. A program could temporarily lock the mouse cursor into the upper left quadrant of a mode 16 graphics screen (which, as Figure 1 indicates, has a resolution of 640 by 350, virtual and physical) by employing the following calls:

```
MOV AX,7
MOV CX,Ø
MOV DX,32Ø
INT 51
MOV AX,8
MOV CX,Ø
MOV DX,175
INT 51
```

The default values effective when the mouse driver is initialized allow the cursor to move to any part of the screen.

THE BUTTONS In addition to function 3, which returns the mouse button status as well as the current mouse position, functions 5 and 6 are provided to aid in decoding button action. Service 5 returns information regarding button presses, while function 6 reports information concerning button releases. Either is called with the function number in AX and a value that specifies which button information is being requested in BX. Zero denotes the left button and 1 denotes the right.

Function 5 returns in AX the byte whose first two bits reflect the state of each button. As with function 3, bit 0 corresponds to the left button and bit 1 to the right. BX returns the number of times the button specified in BX on input has been pressed since the last call to this function. CX and DX indicate what the mouse position was at the time of the last press. Function 6 operates exactly the same way for button releases. Register BX returns the number of releases, and CX and DX return the mouse coordinates that were in effect when the indicated button was last released.

Button releases are at least as important as button presses in the world of mice. Selections from pull-down menus are usually made by dragging a selection bar down the menu with one button depressed, then releasing it when the desired choice is highlighted. As a result, the two are given equal billing in the Microsoft driver.

MOUSE MOTION COUNTERS In addition to tracking the screen coordinates of the mouse at all times, the software driver keeps a raw tally of mouse motions. Mouse movement is measured in small increments called mickeys; there are approx-

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■ PC LAB NOTES

imately 200 mickeys to the inch. [*Ouch! Microsoft's president, William Gates, also disclosed to us that the GW in GW BASIC stands for Gee Whiz.—Ed.*] Function 11 returns the number of mickeys the mouse has moved since the last call. On return, CX holds the horizontal count, and DX the vertical count. Both are in the form of signed integers, so possible values range from −32768 to 32767. An overflow causes the count to wrap around. Positive vertical movement is defined as up; positive horizontal movement is toward the right.

Programs written to incorporate the mouse typically don't bother with mickey counts, since the driver performs the arduous task of translating them into corresponding cursor movements. There are times, however, when the mickey count can be handy. One instance is illustrated in the MOUSEKEY utility that accompanies this article, where the program is interested in the most recent direction of movement, not in its magnitude or the absolute address of the mouse cursor. The code merely has to call function 11 and check the sign of the returned indicators.

■ Programs written to incorporate the mouse typically don't bother with mickey counts.

By default, the driver moves the mouse cursor one pixel horizontally for every mickey of horizontal mouse movement. The default vertical ratio is one pixel for every 2 mickeys. In 80-column text modes where a character cell is made up of an 8-by 8-pixel array, the mouse must be moved about $^{8}/_{200}$ inch (or $^{1}/_{25}$) to advance the cursor one character horizontally. Since vertical resolution is substantially less than horizontal, it takes $^{16}/_{200}$ inch of vertical movement to move it up or down a line. Because the desired mouse sensitivity will vary from one application to the next, function 15 lets the programmer modify the default mickey/pixel ratios. CX is loaded with the desired number of mickeys per 8 pixels for horizontal movement, and DX with the same for vertical motion. The following program lines double the amount of motion required to move the mouse cursor a given distance:

```
MOV AX,15
MOV CX,16
MOV DX,32
INT 51
```

The ratios can be modified on the fly to cause the mouse cursor to move more slowly in one portion of the display than in another. This technique is especially useful when one area requires a high degree of accuracy in locating the pointer while another calls for quick, undelayed response.

THE RESET FUNCTION Function 0 of the mouse driver serves a dual purpose. First, it allows an application to determine whether or not the mouse hardware and software are installed. Second, it resets a whole host of parameters pertinent to mouse operation to their power-up conditions.

No input is required other than a value of 0 in AX specifying the function number. Return codes consist simply of a −1 or 0 passed back in AX (indicating that the mouse hardware and driver are or are not installed) and a −1 or 0 in BX. The BX register is an indicator of how many buttons the mouse has. A −1 means it has two, and a 0 means it has some other number. This was presumably included to accommodate possible expansion to more than two buttons. But the most important aspect of this function is its ability to completely initialize the state of the driver software.

A reset induced through function 0 hides the cursor and centers it on the screen, restores the graphics cursor to the default arrow shape and the software text cursor to reverse video form, resets the 8:8 and 16:8 horizontal and vertical mickey/pixel ratios, and more. Maximum and minimum cursor position values are set to encompass the entire viewing area. Any attached user-defined subroutines (of which more later) are deactivated. In short, it's usually the first call made when a mouse application takes over, not only to verify that the mouse is connected and the driver is loaded, but also to ensure that any changes a previous program has made to the driver state are repaired.

Should you ever have cause to check the mouse hardware/software status sometime after startup, you won't want to use function 0. An unfortunate side effect is that any alterations you've made will be lost. There are a couple of ways around that. One is to use a procedure prescribed in the *Programmer's Reference* manual that checks to see if the interrupt 51 vector is pointing to an empty IRET instruction. The other is to call function 22 to save the current mouse driver state, call function 0, then use function 23 to restore the saved state. Function 22 is called with ES:DX pointing to a buffer area where parameters will be saved. Function 23 likewise is called with ES:DX addressing the buffer. Thus, several different states can be defined and saved in separate areas. Function 21 can be invoked beforehand to determine the required buffer size. On return, BX specifies the minimum buffer capacity in bytes.

■ Ratios can be modified on the fly to cause the mouse cursor to move more slowly in one portion of the display.

You can probably envision numerous uses for functions 22 and 23. If, for example, you created a mouse-operated memory-resident utility, you should save the current driver state on entry and restore it on exit. By so doing, you ensure that operation of the interrupted program won't be disturbed if it too uses a mouse.

USER-DEFINED SUBROUTINES One of the most potentially useful of the mouse programming services is function 12. Function 12 is called to address a routine that is given control by the mouse driver whenever a specified event occurs. This interrupt subroutine is analogous to a resi-

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dent utility that takes over when a "hot key" is pressed.

Function 12 is called with ES:DX holding the address of the routine and CX defining a call mask. The call mask is a word whose first 5 bits each correspond to a specific event. The bit assignments are

```
0     Mouse moves
1     Left button pressed
2     Left button released
3     Right button pressed
4     Right button released
```

To link the subroutine to an event, set the corresponding call mask bit to 1. If, for instance, you wanted your code to receive control when either button is pressed, assign the mask the value 10. The following example enables a user-defined subroutine called MOUSE and specifies that it should be vectored to anytime the mouse cursor position changes:

```
MOV AX,12
MOV CX,1
MOV DX,OFFSET MOUSE
```

It is assumed that ES already addresses the MOUSE code segment. Note that when the subroutine receives control, a wealth of information is available in the registers listed in Figure 2. The condition mask has exactly the same format as the call mask specified when function 12 was originally invoked. The application can check the first five bits to determine what event precipitated the transfer of control. The button status word is identical to the one returned by functions 5 and 6.

You should note one important point when coding user-defined subroutines. The mouse driver transfers control by executing the equivalent of a far call to the subroutine, pushing the contents of both CS and IP onto the stack. If you're working in assembly language, you should define the routine as a far procedure so that the RET instruction that is generated by the assembler will be a far return.

The possibilities for this service are seemingly endless. You can use it to add mouse capabilities to existing programs by installing your own code in memory through interrupt 27h (or interrupt 21h, function 31h). It can also be included in a standalone application to simplify the task of trapping events. Its origins, in fact, date back to a time when the authors of *Microsoft Word* needed such a capability to fully integrate the mouse into their product. It is the foundation of the short utility that is presented in this article that adds mouse power to existing word processors, text editors, spreadsheets, and a number of other independent applications.

```
AX      Condition mask
BX      Button state
CX,DX   Horizontal and vertical cursor coordinates
DI,SI   Horizontal and vertical mickey counts
```

Figure 2: *Register information available when the MOUSE subroutine is called.*

The same restrictions apply to using DOS services from within a mouse interrupt routine that apply to any resident code. Since interrupt 21h routines (and others, like interrupts 25h and 26h) are nonreentrant, a routine that indiscriminately breaks in on another cannot use DOS services unless it can verify that a DOS service was not interrupted. BIOS routines may be used freely. User-defined subroutines do not need to save register values on entry for restoration on exit: the driver itself takes care of that.

The vector that enables a user-defined subroutine hangs around even after an application that uses it is finished. If your code uses function 12, disable the interrupt routine before termination either by calling function 0 or by invoking function 12 with the call mask set to 0.

THE VIDEO INTERFACE The days of writing programs that bypass the BIOS and deal directly with the hardware are fast approaching an end. Already, applications that manipulate the video circuitry cause problems in environments like *Microsoft Windows*. You'll see the phrase "ill-behaved programs" in print more frequently as the computer industry inches its way toward multitasking operating systems. The mouse driver represents still another reason for restraint in dealing directly with video hardware.

The mouse driver depends heavily upon the PC's visual interface. As such, it must maintain a constant awareness of the state of the video environment around it. Its first line of defense is to intercept all calls made to interrupt 10h requesting a change in video mode. On a standard Color/Graphics Adapter, altering the current display mode involves writing values to a series of registers contained in the 6845 CRT Controller. Very few applications written for the CGA took on the challenge of dealing directly with the hardware. It was, after all, an intimidating process for all but the most experienced programmer, and the capability of the adapter was limited enough that all but a few useful features were implemented by the BIOS.

The introduction of the Enhanced Graphics Adapter changed all that. An order of magnitude more complex than its predecessors, the EGA offers a multitude of tempting new features ranging from smooth scrolling to split screens, redefinable fonts, and much, much more. The extended EGA BIOS directly supports only a few of these capabilities. As a result, the programmer who wishes to take advantage of them is reduced to dealing with a confusing array of EGA registers that are by and large—like their more primitive CGA counterparts—write-only. This presents an imposing problem for the mouse driver. It cannot accurately monitor action in and around the EGA if renegade programs are forced to manipulate registers themselves without the benefit of the BIOS. Owners of Microsoft's *Flight Simulator* may have noticed the warning that the Microsoft Mouse can't be used when the program is running on an EGA. That's probably a result of the reasons above.

THE RIL Thus was born the EGA Register Interface Library. The RIL is a set of appended interrupt 10h functions that the mouse driver automatically loads when it senses an EGA. Applications written with EGA/mouse compatibility in mind can indirectly manipulate EGA registers through the RIL and at the same time provide the driver with a means of keeping informed. All EGA registers except for the two external Input Status Registers are accessible through the RIL.

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■ PC LAB NOTES

The RIL was created especially for use in video modes 13, 14, 15, and 16. The *Programmer's Reference* manual warns that, in these modes, "if your program tries to set the EGA registers directly . . . the mouse cursor will not be drawn correctly." The reason is this: when the mouse driver draws the graphics cursor into video memory in one of these modes, it has to manipulate the EGA's Graphics Controller Bit Mask and Mode Registers. To prevent an underlying applications program that uses the same registers from being disturbed, the register values must be restored when the mouse driver is finished. But the driver can't obtain the original values from write-only registers.

The philosophy underlying the RIL is an interesting one. Rather than try to categorize and support the myriad EGA functions and capabilities, the authors chose instead to provide a set of function calls permitting an application to write values to most EGA registers. The mouse driver then maintains shadow maps that reflect the current register values. When the driver needs to read one or more values so it can temporarily change them and subsequently restore them, the values can be read from the shadow maps. A side benefit to any program employing the Register Interface Library is that it enjoys the same capability to retrieve values.

With but one exception, the EGA BIOS can be used in conjunction with the RIL as it normally is. The RIL routines are smart enough to remember to intercept calls to change the video mode through interrupt 10h, function 0. But calls to BIOS function 0Bh to set the color palette must be avoided in deference to setting the palette registers through the RIL routines. This doesn't really place an additional burden on the programmer; there's nothing easy about EGA programming, and the RIL makes it neither easier nor harder. Its charter is not to provide a medium-level coding interface, but merely to make sure that the mouse driver for which it was created is not left in the dark.

The EGA Register Interface Library provides nine documented functions accessible through interrupt 10h. The function number is placed in AH before the INT instruction is executed. Registers BX, CX, DX, and ES are used as well. The level of detail involved in using the functions prohibits a full explanation here; refer to the *Microsoft Mouse Programmer's Reference Guide* for an in-depth discussion and to Table 1 for a listing. I should briefly note, however, that the first three odd-numbered functions (F1h, F3h, and F5h) allow you to write to individual or collective registers. Functions F0h, F2h, and F4h complement them by allowing you to

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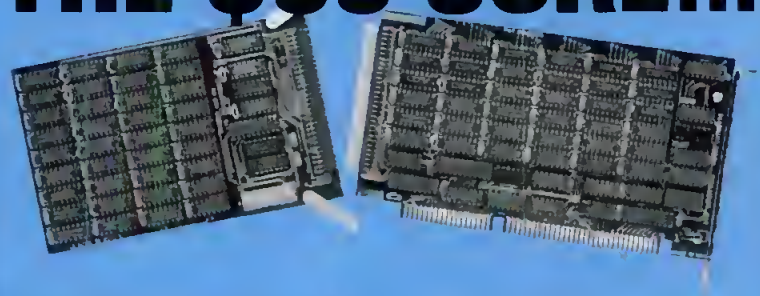

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■ PC LAB NOTES

read values back from the shadow maps. Registers are grouped by the EGA chips on which they are found. Function F6h and F7h provide the flexibility to define default values for any and all registers and to revert to them instantly. Function FAh returns the RIL version number and whether or not the mouse driver is present.

The *Programmer's Reference* also outlines a few minor but notable incompatibilities between the RIL and the EGA hardware. An example is the problem in addressing the Sequencer Memory Mode Register and the Graphics Controller Miscellaneous Register. Both require that the sequencer (which coordinates requests for access to video memory) and all interrupts be disabled before writing to the registers, presumably to avoid a potential erosion of video memory. That's a new one on me, since I find no mention of it in IBM's *EGA Technical Reference*. The suggested solution is to manipulate these registers directly, forgoing the RIL.

MOUSEKEY The short utility MOUSEKEY.COM presented here gives you a small taste of what a mouse can do for your system. The program's brevity is a tribute to the power of the mouse driver (Microsoft's or a compatible). MOUSEKEY serves not only to provide a useful tool compatible with any system that emulates the Microsoft Mouse but also to illustrate in action a few of the mouse functions I've just discussed.

MOUSEKEY allows a mouse to stand in for the four cursor keys, the PgUp key, and the PgDn key within applications that normally don't support a mouse. Load the program anytime after the mouse driver is loaded, simply by entering

```
[d:][path]MOUSEKEY
```

Thereafter, the left mouse button will emulate the PgUp key, and the right button will mimic the PgDn key. You can simulate a press of any arrow key by moving the mouse in the corresponding direction. MOUSEKEY works in conjunction with the BIOS keyboard driver and doesn't impede normal operation of the keys it emulates. It's the perfect alternative to sluggish keyboard typematic rates that make a lengthy cursor move last an etemity.

You'll be amazed at how a mouse can limber up a slow word processor. You can zip the cursor from one part of the screen to another (or repeat the last command on the DOS command level by moving the mouse to the right).

Figure 3 contains a listing of the assembler source code for MOUSEKEY.COM, and Figure 4 is a BASIC program you can run to create MOUSEKEY. As usual, the .COM, .ASM, and .BAS versions of

```
;MOUSEKEY.COM for the Microsoft Mouse - 1987 by Jeff Prosise
;
bios_data       segment at 40h
                org 1Ah
buffer_head     dw ?                    ;pointer to keyboard buffer head
buffer_tail     dw ?                    ;pointer to keyboard buffer tail
                org 80h
buffer_start    dw ?                    ;starting keyboard buffer address
buffer_end      dw ?                    ;ending keyboard buffer address
bios_data       ends
;
code            segment para public 'code'
                assume cs:code
                org 100h
begin:          jmp initialize          ;goto initialization code
;
copyright       db 'Copyright 1987 Ziff-Davis Publishing Co.'
author          db 'Written by Jeff Prosise'
vcount          db 3                    ;vertical delay counter
hflag           dw ?                    ;horizontal count sign flag
vflag           dw ?                    ;vertical count sign flag
keycode         db 4Dh,4Bh,50h,48h      ;keycodes for cursor keys
;
;-----------------------------------------------------------------------------
;MOUSE subroutine is handed control by the mouse driver when either the mouse
;is moved or either button is pressed.
;-----------------------------------------------------------------------------
mouse           proc far
;
;Determine which event occurred and branch accordingly.
;
                test ax,2               ;was the left button pressed?
                jnz pgup                ;yes, then branch
                test ax,8               ;was the right button pressed?
                jnz pgdn                ;yes, then branch
;
;Move the cursor in the direction indicated by the most recent mouse move.
;
mouse0:         mov ax,11               ;function 11
                int 51                  ;read mouse motion counters
                mov hflag,0             ;initialize sign flags
                mov vflag,2
                xor al,al               ;zero AL for extended keycode
                cmp cx,0                ;horizontal count positive?
                jge mouse1              ;yes, then branch
                inc hflag               ;record negative condition
                neg cx                  ;convert negative to positive
mouse1:         cmp dx,0                ;vertical count positive?
                jge mouse2              ;yes, then branch
                inc vflag               ;record negative condition
                neg dx                  ;convert negative to positive
mouse2:         mov bx,hflag            ;assume motion was horizontal
                cmp cx,dx               ;was the assumption correct?
                jae mouse3              ;yes, then branch
                mov bx,vflag            ;no, then correct it
                dec vcount              ;decrement vertical delay count
                jz mouse3               ;continue if count is zero
                ret                     ;exit if it's not
mouse3:         mov vcount,3            ;reset delay counter
                mov ah,keycode[bx]      ;get keycode from table
                jmp insert              ;insert it into keyboard buffer
;
;The left button was pressed.  Load AX with the keycode for the PgUp key.
;
pgup:           mov ax,4900h            ;load keycode
                jmp insert              ;insert it into the keyboard buffer
;
;The right button was pressed.  Load AX with the keycode for PgDn.
;
pgdn:           mov ax,5100h            ;load keycode
;
;Insert the keycode in AX into the keyboard buffer.
;
insert:         mov bx,bios_data        ;point DS to BIOS data area
                mov ds,bx
                assume ds:bios_data
                cli                     ;disable interrupts
                mov bx,buffer_tail      ;get buffer tail address
                mov dx,bx               ;transfer it to DX
                add dx,2                ;calculate next buffer position
                cmp ds,buffer_end       ;did we overshoot the end?
                jne insert1             ;no, then continue
                mov ds,buffer_start     ;yes, then wrap around
insert1:        cmp ds,buffer_head      ;is the buffer full?
                je insert2              ;yes, then end now
                mov [bx],ax             ;insert the keycode
                mov bx,dx               ;advance the tail
                mov buffer_tail,bx      ;record its new position
insert2:        sti                     ;enable interrupts
                assume ds:nothing
                ret                     ;exit user-defined subroutine
mouse           endp
;
;-----------------------------------------------------------------------------
;INITIALIZE routine points the mouse driver to the user-defined subroutine,
;then leaves it resident in memory.
;-----------------------------------------------------------------------------
initialize      proc near
                jmp init0               ;skip transient data area
;
errmsg          db 13,10,'Mouse Not Installed',13,10,'$'
;
;Make sure the mouse hardware and software are in place.
;
init0:          mov ax,0                ;function 0
                int 51                  ;get installation flag
                or ax,ax                ;is AX zero?
                jne init1               ;no, then installation OK
                mov ah,9                ;print error message and abort
                lea dx,errmsg
                int 21h
                ret
;
;Point the mouse driver to the user-defined subroutine that will be executed
;everytime the mouse is moved or a button is pressed.
;
init1:          mov ax,12               ;function 12
                mov cx,11               ;subroutine call mask
                mov dx,offset mouse     ;point ES:DX to subroutine
                int 51                  ;pass information to mouse driver
;
;Terminate but leave the user-defined subroutine resident in memory.
;
                lea dx,initialize       ;point DX to end of resident code
                int 27h                 ;terminate-but-stay-resident
initialize      endp
;
code            ends
                end begin
```

Figure 3: *The source code listing for MOUSEKEY.COM.*

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■ PC LAB NOTES

MOUSEKEY are available for modem download from the PC Magazine Interactive Reader Service. The proper procedure for using this no-charge service is described in a sidebar to this month's Programming/Utilities column.

The backbone of the utility is mouse function 12. Function 12, you'll recall, lets the programmer point the driver to an interrupt routine that will receive control when a specified condition is met. MOUSEKEY installs a routine through interrupt 27h (just as if it were a resident utility) that takes over when the mouse is moved or when either button is depressed. The interrupt code checks the value of AX on entry to determine what event triggered the interrupt. If it was a press of the left button, MOUSEKEY inserts the keycode for PgUp into the keyboard buffer. An application simply thinks the PgUp key was pressed. If it was the right button, the PgDn keycode is generated. If it was neither, function 11 is invoked to read the mouse motion counters and see in which direction the mouse was moved. The magnitudes of the horizontal and vertical displacements are compared, and the larger of the two is given precedence. The sign of the count reveals the sense of the horizontal or vertical motion, and MOUSEKEY then feeds the corresponding cursor keycode to the keyboard BIOS.

At initialization, MOUSEKEY uses function 0 (supplied by the mouse driver) to verify that the mouse hardware and software are installed. The end result is a sound and very safe add-on for almost any program that uses the cursor and the PgUp and PgDn keys. It's sound because it's simple, and it's safe because, unlike troublesome resident utilities that chain themselves into the keyboard interrupt (and sometimes a host of others), MOUSEKEY remains quietly resident without usurping a single interrupt vector. This is probably the sort of thing the designers of DOS had in mind when they included the terminate-and-stay-resident feature.

```
100 REM -- BASIC PROGRAM TO CREATE MOUSEKEY.COM
110 OPEN "MOUSEKEY.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  35
150    LINESUM = 0
160    FOR J = 1 TO 8
170       READ BYTE
180       CHECKSUM = CHECKSUM + BYTE
190       LINESUM = LINESUM + BYTE
200       IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ LINECHECK
240    IF LINECHECK <> LINESUM THEN PRINT "Error in Line";280 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 24292 THEN PRINT "Successful Completion!" : END
280 PRINT "COM file is not valid!" : END
290 DATA    233,   213,     0,    67,   111,   112,   121,   114,   971
300 DATA    105,   103,   104,   116,    32,    49,    57,    56,   622
310 DATA     55,    32,    90,   105,   102,   102,    45,    68,   599
320 DATA     97,   118,   105,   115,    32,    80,   117,    98,   762
330 DATA    108,   105,   115,   104,   105,   110,   103,    32,   782
340 DATA     67,   111,    46,    87,   114,   105,   116,   116,   762
350 DATA    101,   110,    32,    98,   121,    32,    74,   101,   669
360 DATA    102,   102,    32,    80,   114,   111,   115,   105,   761
370 DATA    115,   101,     3,     0,     0,     0,     0,    77,   296
380 DATA     75,    80,    72,   169,     2,     0,   117,    86,   601
390 DATA    169,     8,     0,   117,    87,   184,    11,     0,   576
400 DATA    205,    51,    46,   199,     6,    67,     1,     0,   575
410 DATA      0,    46,   199,     6,    69,     1,     2,     0,   323
420 DATA     50,   192,   131,   249,     0,   125,     7,    46,   800
430 DATA    255,     6,    67,     1,   247,   217,   131,   250,  1174
440 DATA      0,   125,     7,    46,   255,     6,    69,     1,   509
450 DATA    247,   218,    46,   139,    30,    67,     1,    59,   807
460 DATA    202,   115,    13,    46,   139,    30,    69,     1,   615
470 DATA     46,   254,    14,    66,     1,   116,     1,   203,   701
480 DATA     46,   198,     6,    66,     1,     3,    46,   138,   504
490 DATA    167,    71,     1,   235,    10,   144,   184,     0,   812
500 DATA     73,   235,     4,   144,   184,     0,    81,   187,   908
510 DATA     64,     0,   142,   219,   250,   139,    30,    28,   872
520 DATA      0,   139,   211,   131,   194,     2,    59,    22,   758
530 DATA    130,     0,   117,     4,   139,    22,   128,     0,   540
540 DATA     59,    22,    26,     0,   116,     8,   137,     7,   375
550 DATA    139,   218,   137,    30,    28,     0,   251,   203,  1006
560 DATA    235,    25,   144,    13,    10,    77,   111,   117,   732
570 DATA    115,   101,    32,    78,   111,   116,    32,    73,   658
580 DATA    110,   115,   116,    97,   108,   108,   101,   100,   855
590 DATA     13,    10,    36,   184,     0,     0,   205,    51,   499
600 DATA     11,   192,   117,     9,   180,     9,   141,    22,   681
610 DATA    219,     1,   205,    33,   195,   184,    12,     0,   849
620 DATA    185,    11,     0,   186,    75,     1,   205,    51,   714
630 DATA    141,    22,   216,     1,   205,    39,     0,     0,   624
```

Figure 4: *A BASIC program that will automatically create MOUSEKEY.COM.*

COMPATIBILITY MOUSEKEY will work with either of the Microsoft mice (bus version or serial version) or with any mouse that will emulate them. Microsoft compatibility is a touchy issue with some mouse manufacturers, because no single unit is really well enough established to claim that it defines the standard. Nonetheless, Microsoft is a dominating force in the market, and some of the mice offered by competing companies are either Microsoft compatible or will run in a Microsoft-compatible mode (usually after a special driver is loaded). If you use something other than the Microsoft Mouse, *Microsoft Word* provides a veritable torture test for mouse drivers claiming compatibility. Borland's *Reflex* is also an excellent measure of compatibility.

The subject of mouse programming could easily fill an entire volume. One aspect of it, namely, programming in a higher-level (product-specific) mouse programming language, is discussed in the sidebar "The Mouse Menu Language." If you're interested in learning more about mouse programming, pick up a copy of the *Microsoft Mouse Programmer's Reference Guide*, even if you have to buy their mouse to do it. You may find it more than an educational exercise; it just might be an investment in the future. In an industry like this, it's not often that one has the opportunity to catch an up elevator while it's still on the ground floor.

Jeff Prosise is a frequent contributor to PC Magazine.

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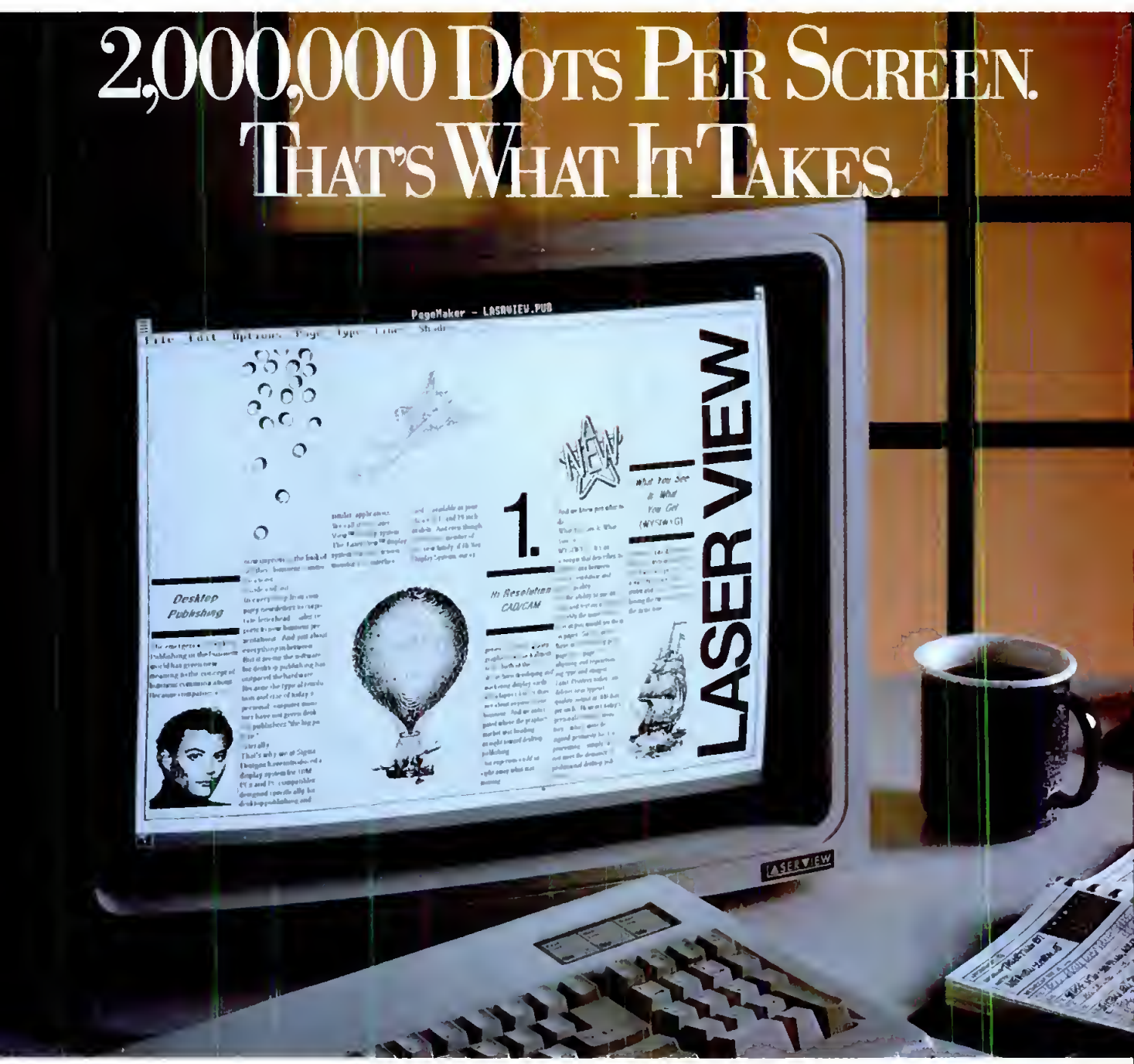

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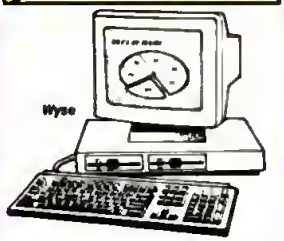

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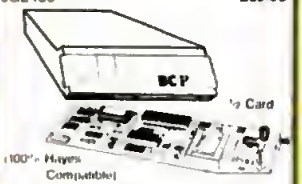

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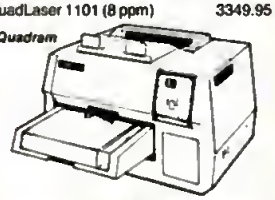

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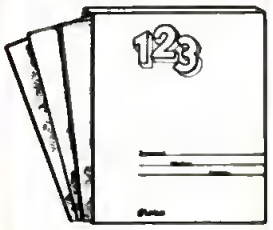

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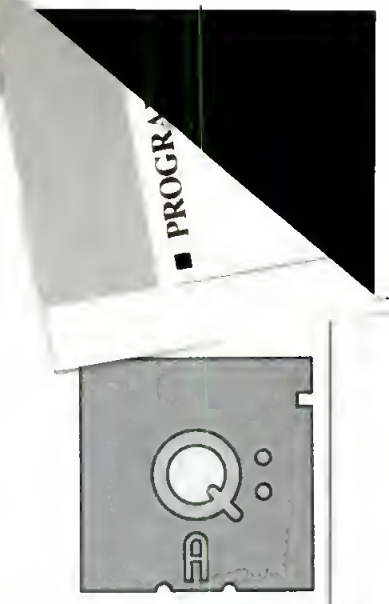
■ PROGRAMMING/UTILITIES ■ STEVE HOLZNER



YOUR POP-UP STENOGRAPHER

Here's a handy five-page notepad utility that pops up to let you save your thoughts when you're in the middle of running another applications program.

A couple of years ago (it was just in time to get buried by *SideKick*), I wrote a short utility called NPAD (*PC Magazine*, Volume 3 Number 25). NPAD was a small (250-character), memory-resident notepad you could pop up at any point to hold comments or phone numbers temporarily. But while pop-up *anything* was hot stuff at the time, there wasn't much else you could do with NPAD. You couldn't even save its contents to disk.

Since then, of course, the state of the art in TSR utilities has made amazing advances, and you can now write notepad programs to do just about anything but tell you what you weigh. And *SideKick*'s own nasty habit of stealing every interrupt that isn't nailed down (how many times have you read, "Be sure to load *SideKick* last"?) has made a lot of people want to get along without it. So the time has come for a new notepad—I call it PAD—that adds a bit more razzle-dazzle to memo making.

The new PAD lets you page through (and save) up to five pages, each of which is about 2½ times the size of the original NPAD. It lets you choose your "trigger" key and the colors both of the letters and of their background (the pad itself). You can change the colors on the fly (using F1 and F2) or set them as defaults. And with all this, PAD.COM is only about 300 bytes longer than NPAD.COM.

PAD takes up more room in memory, however. When installed, it writes over its installation code and also reserves some additional memory space after the program for storing the notepad data. In all, PAD uses about 5½ K of memory. You can use it at any time—when another program is running, when you're editing, or when you're working on a spreadsheet.

GETTING YOUR OWN PAD The easiest way to get a copy of PAD.COM is to download it from the PC Magazine Interactive Reader Service, as explained in the accompanying sidebar. If you wish to enter the program yourself, the assembler code is listed in Figure 1, and Figure 2 is a BASIC program that will create PAD.COM when you first run it. (As discussed below, starting with PAD.BAS is the easiest way to set up the program's defaults.) PAD.ASM and PAD.BAS are also available for downloading from the PC-IRS.

The syntax for installing PAD.COM is simply

```
[d:][path]PAD
```

You can enter this either at the DOS prompt or—more sensibly—as a line in your AUTOEXEC.BAT file. PAD makes an effort to be a congenial utility—it should not conflict with other memory-resident utilities unless they are particularly aggressive. For example, if your utility decides to move the keyboard buffer to its own location, it will either cause PAD to

```
INTERRUPTS      SEGMENT AT 0H   ;This is where the keyboard interrupt
        ORG     09H*4           ;holds the address of its service routine
KEYBOARD_INT    LABEL   WORD
        ORG     21H*4           ;holds the address of its service routine
DOS_INT         LABEL   WORD
INTERRUPTS      ENDS

SCREEN  SEGMENT AT 0B000H       ;A dummy segment to use as the
SCREEN  ENDS                    ;Extra Segment

ROM_BIOS_DATA   SEGMENT AT 40H  ;BIOS statuses held here, also keyboard buffer

        ORG     1AH
        HEAD DW     ?                   ;Unread chars go from Head to Tail
        TAIL DW     ?
        BUFFER      DW      16 DUP (?)          ;The buffer itself
        BUFFER_END  LABEL   WORD

ROM_BIOS_DATA   ENDS

CODE_SEG        SEGMENT
        ASSUME  CS:CODE_SEG
        ORG     1000            ;ORG = 1000 to make this into a .COM file
FIRST:  JMP     LOAD_PAD        ;First time through jump to initialize routine

        COPY_RIGHT      DB '(C)1987 S Holsner'
        INT21   LABEL   DWORD   ;Point to next two words for jump.

OLD_DOS_IST     DW 2 DUP(?)     ;Store original DOS INT21 address here.
FIRST_FLAG      DB 1            ;First time through? Get COMMAND address
COMMAND_ADDR    DW ?            ;Store IP of calling routine in COMMAND.
OLD_DS          DW 1            ;Keep DS:DX of old keyboard buffer.
OLD_DX          DW 160Ah
KEY1    DB 'SAVE', 0DH
KEY2    DB 'save', 0DH
KEY3    DB 'Save'
CR      DW  0DH,0AH,'$'         ;Use this <cr> to send to DOS.
FILE_DONE       DB      0DH,0AH,'PAD.TXT created.',0DH,0AH,'$'
CNTRL_N_FLAG    DW      0               ;Cntrl-N on or off
FILENAME        DW      'PAD.TXT',0
PAD_CURSOR      DW      0               ;Current position in pad
CURSOR_STORAGE  DW      0,680,1280,1HH6,2480  ;Hold cursor each page.
PAD_OFFSET      DW      0               ;Chooses 1st 25# bytes or 2nd
PAD_BEGIN       DW      0               ;Beginning of current page.
PAD_END         DW      500             ;End of current page.
PAGE_NUMBER     DW      0               ;Page Number 0-4.
FIRST_POSITION  DW      ?               ;Position of 1st char on screen
ATTRIBUTE       DB      1A2 ;Pad Attributes 1EH better for color screens
FORE_ATTR       DW      0
BACK_ATTR       DB      0
SCREEN_SEG_OFFSET       DW      0       ;0 for mono, 8000H for graphics
IO_CHAR         DW      ?               ;Holds addr of Put or Get_Char
STATUS_PORT     DW      ?               ;Video controller status port
OLD_KEY_INT     LABEL   WORD
```

(continues)

Figure 1: *The assembly language code for PAD.COM.*

crash or PAD will cause it to crash. In any event, try loading PAD first since it is specially written not to bother any other utility. [XyWrite *users should be warned that the keyboard handler in PAD.COM may give trouble with* XyWrite's *XYKBD .COM. You can try loading PAD before XYKBD or deactivating the latter (by entering XYKBD DE), but even then some difficulties may be encountered.—Ed.*]

Once loaded, you activate PAD by pressing its trigger key. The default is Ctrl-N, but if you create the .COM file by running the BASIC program in Figure 2 (as recommended below), you can set both the default "hot key" and the colors without the usual DEBUG session. When activated, PAD appears in the upper-right-hand part of the screen, with the page number at the bottom of the window. To switch pages, just push PgUp or PgDn. Anything you type now will appear in the pad—you can even type the "extended ASCII" characters (smiley faces, diamonds, or arrows, for example) by holding down the Alt key and typing the character's ASCII code on the number pad.

You can temporarily change the pad's colors to complement the current program you're running, by using F1 (to change the color of the letters) and F2 (for the pad itself). If you want to erase a character, use the Backspace (rubout) key, just as you would expect. The Del key will erase a whole page. When you're done notetaking, type the trigger key again. The pad vanishes, and you're back to the program you were working on before you started taking notes. The pad keeps what you've typed safely stored for the next time you need it.

PAD has a more permanent memory, too. PAD is installed to watch the commands you type to DOS. To store all five pages on disk in a file named PAD.TXT, just type SAVE at the DOS prompt, as you would any normal DOS command, like COPY or DIR. PAD will pick it up and create PAD.TXT (incidentally writing over any previous versions), which will hold everything you've typed into the notepad.

If five pages isn't big enough for your notepad needs, you can create multiple pads (even in different colors) and make them correspond to different trigger keys. For example, the Ctrl-N pad could be just for notes, and the Ctrl-O pad could be for outlines. If you wish to do this, however, each time you create a new PAD.COM be sure to give it a new name. Remember, too, that you will have to rename each PAD.TXT you save, or the next time you

DOWNLOADING PAD

The programs that appear in our Programming/Utilities column (as well as other programs we publish) can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards), as long as no charge is involved. However, making copies for any commercial purpose is strictly prohibited.

The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1200 (or 300) bps, 8 data bits, 1 stop bit, no parity. PC-IRS files with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission.

PAD.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create PAD.COM when run once in BASIC. PAD.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft) and execute the following commands:

```
MASM PAD;
LINK PAD;
EXE2BIN PAD PAD.COM
```

PAD at a Glance

PAD.COM is a memory-resident notepad that pops up over running applications programs and allows you to save up to five pages of comments, phone messages, and the like. The contents of PAD remain in memory until the PC is rebooted but can be saved to a disk file called PAD.TXT by entering SAVE at the DOS prompt.

The installation syntax for PAD .COM is

```
[d:][path]PAD
```

The default trigger key for PAD.COM is Ctrl-N, but this and the foreground and background color parameters may be changed by creating the .COM file using the self-prompting PAD.BAS program. When its pop-up window is open, the F1 and F2 keys may be used temporarily to reset letter and background colors, respectively. PgUp and PgDn scroll through the five window pages, and Del deletes an entire page. The Backspace key can also be used in editing.

While compatible with most TSR (memory-resident) programs, some difficulty has been experienced with *XyWrite*. Multiple copies of PAD .COM (under different names) using different trigger keys and different colors can be used to provide more storage, but care must be exercised to rename the created PAD.TXT files, each of which would otherwise overwrite its predecessor.

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■ PROGRAMMING/UTILITIES

```
        OLD_KEYBOARD_INT        DD      ?       ;Location of old kbd interrupt

NEWPAD  PROC    NEAR            ;The keyboard interrupt will now come here.
        ASSUME  CS:CODE_SEG
        PUSH    AX              ;Save the used registers for good form
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    DI
        PUSH    SI
        PUSH    DS
        PUSH    ES
        PUSHF                   ;First, call old keyboard interrupt
        CALL    OLD_KEYBOARD_INT

        ASSUME  DS:ROM_BIOS_DATA        ;Examine the char just put in
        MOV     BX,ROM_BIOS_DATA
        MOV     DS,BX

        MOV     BX,TAIL                 ;Point to current tail
        CMP     BX,HEAD                 ;If at head, kbd int has deleted char
        JE      IN                      ;So leave
        SUB     BX,2                    ;Point to just read in character
        CMP     BX,OFFSET BUFFER        ;Did we undershoot buffer?
        JAE     NO_WRAP                 ;Nope
        MOV     BX,OFFSET BUFFER_END    ;Yes -- move to buffer top
        SUB     BX,2                    ;Point to just read in characterggg
NO_WRAP:MOV     DX,[BX]                 ;Char in DX now
        CMP     DX,3112H                ;Is the char a Cntrl-R?
        JNE     NOT_CNTRL_R             ;No
        MOV     TAIL,BX                 ;Yes -- delete it from buffer
        NOT     CNTRL_R_FLAG            ;Switch Modes
        CMP     CNTRL_R_FLAG,0          ;Cntrl-R off?
        JNE     CNTRL_R_ON              ;No, only other choice is on
CNTRL_R_OFF:
        LEA     DX,PAD
        MOV     PAD_OFFSET,DX
        ADD     PAD_OFFSET,3000
        LEA     AX,PUT_CHAR             ;Make IO call Put_Char as it scans
        MOV     IO_CHAR,AX              ;over all locations in pad on screen
        CALL    IO                      ;Restore screen
IN:     JMP     OUT                     ;Done
CNTRL_R_ON:
        LEA     DX,PAD
        MOV     PAD_OFFSET,DX
        ADD     PAD_OFFSET,3000
        LEA     AX,GET_CHAR             ;Make IO use Get_char so current screen
        MOV     IO_CHAR,AX              ;is stored
        CALL    IO                      ;Store Screen
        CALL    DISPLAY                 ;And put up the pad
        JMP     OUT                     ;Done here.
NOT_CNTRL_R:
        TEST    CNTRL_R_FLAG,1          ;Is Cntrl-R on?
        JZ      IN                      ;No -- leave
        MOV     TAIL,BX                 ;Yes, delete this char from buffer
        CMP     DX,5300H                ;Decide what to do -- is it a Delete?
        JNE     RUBOUT_TEST             ;No -- try Rubout
        PUSH    DS
        PUSH    CS
        POP     DS
        MOV     BX,PAD_END
        DEC     BX
DEL_LOOP:
        MOV     BYTE PTR [BX],' '       ;Move space to current pad position
        DEC     BX                      ;and go back one
        CMP     BX,PAD_BEGIN
        JNZ     DEL_LOOP                ;until done.
        MOV     BYTE PTR [BX],'_'       ;Put the cursor at the beginning
        MOV     DX,PAD_BEGIN
        MOV     PAD_CURSOR,dx   ;qq          ;And start cursor over
        POP     DS
        CALL    DISPLAY                 ;Put up the new pad on screen
        JMP     OUT                     ;And take our leave
RUBOUT_TEST:
        CMP     DX,0E08H                ;Is it a Rubout?
        JNE     CRLF_TEST               ;No -- try carriage return-line feed
        PUSH    DS
        PUSH    CS
        POP     DS
        MOV     BX,PAD_CURSOR           ;Yes -- get current pad location
        CMP     BX,PAD_BEGIN            ;Are we at beginning?
        JLE     NEVER_MIND              ;Yes -- can't rubout past beginning
        MOV     BYTE PTR [BX-1],'_'             ;And move cursor back one
        DEC     PAD_CURSOR              ;Set the pad location straight
        CMP     BX,PAD_END              ;Save page number.
        JE      NEVER_MIND              ;No -- move space to current position
        MOV     BYTE PTR [BX],' '
NEVER_MIND:
        POP     DS
        CALL    DISPLAY                 ;And put the result on the screen
        JMP     OUT                     ;Done here.
CRLF_TEST:
        CMP     DX,1CODH                ;Is it a carriage return-line feed?
        JNE     PGUP_TEST               ;No
        PUSH    DS
        PUSH    CX
        POP     DS
        CALL    CRLF                    ;Yes -- move to next line
        POP     DS
        CALL    DISPLAY                 ;And display result on screen
        JMP     OUT                     ;Done.
PGUP_TEST:
        CMP     DX,4900H
        JNE     PGDN_TEST
        CMP     PAGE_NUMBER,0
        JNZ     DEC_PAGE
        JMP     OUT
DEC_PAGE:
        MOV     BX,PAGE_NUMBER          ;RTORE PAD CURSOR
        ADD     BX,BX
        MOV     CH,PAD_CURSOR
        MOV     CURSOR_STORAGE[BX],CH
        DEC     PAGE_NUMBER
        SUB     BX,2
        MOV     CH,CURSOR_STORAGE[BX]
        MOV     PAD_CURSOR,CX
        MOV     AX,PAGE_NUMBER
        MOV     EX,600
        MUL     EX
        LEA     DX,PAD
        ADD     AX,DX
        MOV     PAD_BEGIN,AX
        ADD     AX,500
        MOV     PAD_END,AX
        CALL    DISPLAY
        JMP     OUT
PGDN_TEST:
        CMP     DX,5100H
        JNE     P1_TEST
        CMP     PAGE_NUMBER,4
        JNE     INC_PAGE
        JMP     OUT
INC_PAGE:
        MOV     BX,PAGE_NUMBER          ;Store pad cursor.
        ADD     BX,BX
        MOV     CH,PAD_CURSOR
        MOV     CURSOR_STORAGE[BX],CH
        INC     PAGE_NUMBER
        ADD     BX,2
        MOV     CH,CURSOR_STORAGE[BX]
        MOV     PAD_CURSOR,CH
        MOV     AX,PAGE_NUMBER
        MOV     BX,600
        MUL     BX
        LEA     DX,PAD
        ADD     AX,DX
        MOV     PAD_BEGIN,AX
        ADD     AX,599
        MOV     PAD_END,AX
        CALL    DISPLAY
        JMP     OUT
P1_TEST:CMP     DX,3B00H
        JNE     P2_TEST
        MOV     AH,FORE_ATTR
        INC     AX
        CMP     AX,16
        JL      OKFORE
        MOV     AH,0
OKFORE: MOV     FORE_ATTR,AH
        AND     ATTRIBUTE,240   ;Clear fore color
        OR      ATTRIBUTE,AX
        CALL    DISPLAY
        JMP     OUT
P2_TEST:CMP     DX,3C00H
        JNE     CHAR_TEST
        MOV     AH,BACK_ATTR
        ADD     AX,16
        CMP     AX,128
        JE      OKBACK
        MOV     AX,0
OKBACK: MOV     BACK_ATTR,AX
        AND     ATTRIBUTE,15    ;Clear back color
        OR      ATTRIBUTE,AH
        CALL    DISPLAY
        JMP     OUT
CHAR_TEST:
        PUSH    DS
        PUSH    CS
        POP     DS
        MOV     BX,PAD_CURSOR           ;Get current pad location
        CMP     BX,PAD_END              ;Are we past the end of the pad?
        JGE     PAST_END                ;Yes -- throw away char
        MOV     byte ptr [bx],DL                ;No -- move ASCII code into pad
        INC     PAD_CURSOR              ;Increment pad location
        INC     BX
        CMP     BX,PAD_END
        JX      PAST_END
        MOV     BYTE PTR [BX],'_'               ;Advance cursor
PAST_END:
        POP     DS
        CALL    DISPLAY                 ;Put result on screen
OUT:    POP     ES      ;Having done Pushes, here are the Pops
        POP     DS
        POP     SI
        POP     DI
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        IRET                    ;An interrupt needs an IRET
NEWPAD  ENDP

DISPLAY PROC    NEAR                    ;Puts the whole pad on the screen
        PUSH    AX
        PUSH    PAD_BEGIN
        POP     PAD_OFFSET
        LEA     AX,PUT_CHAR             ;Make IO use Put-Char so it does
        MOV     IO_CHAR,AX
        CALL    IO                      ;Put result on screen
        POP     AX
        RET                             ;Leave
DISPLAY ENDP

CRLF    PROC    NEAR                    ;This handles carriage returns
        MOV     DI,PAD_END      ;Are we on last line?
        SUB     DI,40
        CMP     PAD_CURSOR,DI
        JGE     DONE                    ;Yes, can't do a carriage return, exit
NEXT_CHAR:
        MOV     BX,PAD_CURSOR           ;Get pad location
        MOV     AX,BX                   ;Get another copy for destructive tests
        SUB     AX,PAD_BEGIN
EDGE_TEST:
        CMP     AX,38                   ;Are we at the edge of the pad display?
        JE      AT_EDGE                 ;Yes -- fill pad with new cursor
        JL      ADD_SPACE               ;No -- Advance another space
        SUB     AX,40                   ;Subtract another line-width
        JMP     EDGE_TEST               ;Check if at edge now
ADD_SPACH:
        MOV     BYTE PTR [BX],' '               ;Add a space
```

(Figure 1 continues)

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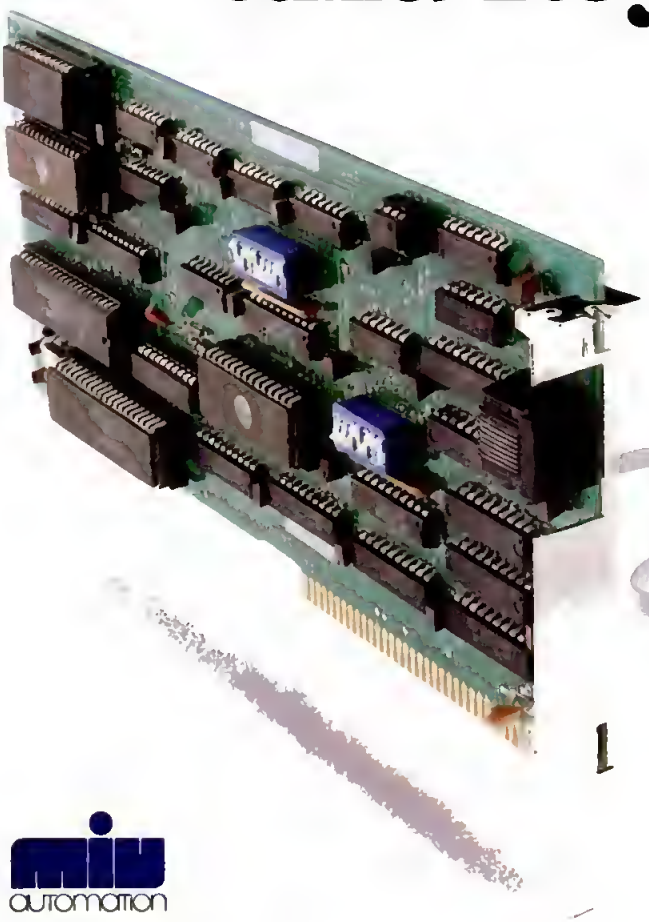

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■ PROGRAMMING/UTILITIES

```
        INC     PAD_CURSOR              ;Update pad location
        JMP     BEST_CHAR               ;Check if at edge now
AT_EDGE:
        MOV     BYTE PTR [BX],' '
        MOV     BYTE PTR [BX+1],'_'             ;Put cursor in next location
        INC     PAD_CURSOR              ;Update pad location to new cursor
DONE:   RET                             ;And out.
CRLF    ENDP

GET_CHAR        PROC    NEAR    ;Gets a char from screen and advances position
        PUSH    DS
        PUSH    DX
        PUSH    CS
        POP     DS

        MOV     BI,2            ;Loop twice, once for char, once for attribute
        MOV     DX,STATUS_PORT  ;Get ready to read video controller status

G_WAIT_LOW:                     ;Start waiting for a new horizontal scan -
        IN      AL,DX           ;Make sure the video controller scan status
        TEST    AL,1            ;is low
        JNZ     G_WAIT_LOW
G_WAIT_HIGH:                    ;After port has gone low, it must go high
        IN      AL,DX           ;before it is safe to read directly from
        TEST    AL,1            ;the screen buffer in memory
        JZ      G_WAIT_HIGH

        MOV     AH,ES:[DI]      ;Do the move from the screen, one byte at a time
        INC     DI              ;Move to next screen location
        DEC     SI              ;Decrement loop counter
        CMP     SI,0            ;Are we done?
        JE      LEAVE           ;Yes
        MOV     BYTE PTR [BX],AH        ;No -- put char we got into the pad
        JMP     G_WAIT_LOW      ;Do it again
LEAVE:  INC     BX
        MOV     BYTE PTR [BX],AH
        INC     BX              ;Update pad location
        POP     DX
        POP     DS
        RET
GET_CHAR        ENDP

PUT_CHAR        PROC    NEAR    ;Puts one char on screen and advances position
        PUSH    DS
        PUSH    CX
        PUSH    DX
        PUSH    CS
        POP     DS
        MOV     AH,BYTE PTR [BX]        ;Get the char to be put onto the screen
        MOV     SI,2            ;Loop twice, once for char, once for attribute
        MOV     DX,STATUS_PORT  ;Get ready to read video controller status
P_WAIT_LOW:                     ;Start waiting for a new horizontal scan -
        IN      AL,DX           ;Make sure the video controller scan status
        TEST    AL,1            ;is low
        JNZ     P_WAIT_LOW
P_WAIT_HIGH:                    ;After port has gone low, it must go high
        IN      AL,DX           ;before it is safe to write directly to
        TEST    AL,1            ;the screen buffer in memory
        JZ      P_WAIT_HIGH
        MOV     ES:[DI],AH      ;Move to screen, one byte at a time

        LEA     CX,PAD
        ADD     CX,3888
        CMP     PAD_OFFSET,CX
        JNE     GET_ATT         ;We are restoring pad here.
        MOV     AH,BYTE PTR [BX+1]
        JMP     SHORT   IBCOI

GET_ATT:MOV     AH,ATTRIBUTE    ;Load attribute byte for second pass
INCOI:  INC     DI              ;Point to next screen position
        DEC     SI              ;Decrement loop counter
        JNE     P_WAIT_LOW      ;If not zero, do it one more time
        INC     BX              ;Point to next char in pad
        LEA     CX,PAD
        ADD     CX,3888
        CMP     PAD_OFFSET,CX
        JBE     RETRN
        INC     BX
RSTRS:  POP     DS
        POP     CX
        POP     DS
        RET                     ;Exeunt
PUT_CHAR        ENDP

ID      PROC    NEAR            ;This scans over all screen positions of the pad
        ASSUME  ES:BCSEEN               ;One screen as extra segment
        MOV     BX,SCREEN
        MOV     ES,BX
        MOV     DI,BCKBBB_BEG_OFFSET    ;DI will be pointer to screen position
        ADD     DI,FIRST_POSITION       ;Add width of screen minus pad width
        MOV     BX,PAD_OFFSET           ;BX will be pad location pointer
        MOV     CX,15                   ;There will be 15 lines
LINE_LOOP:
        MOV     DX,48                   ;And 25 spaces across
CHAR_LOOP:
        CALL    IO_CHAR                 ;Call Put-Char or Get-Char
        DEC     DX                      ;Decrement character loop counter
        JNZ     CHAR_LOOP               ;If not zero, scan over next character
        ADD     DI,FIRST_POSITION       ;Add width of screen minus pad width
        LOOP    LINE_LOOP               ;And now go back to do next line
        RET                             ;Finished
IO      ENDP

DOS_WATCH       PROC    FAR             ;The DOS interrupt will now come here.
        PUSH    ES                      ;Save all used registers.
        PUSH    DS
        PUSH    BP
        PUSH    AX
        PUSH    BX
        PUSH    CX
        CMP     AH,8AH                  ;Is this the DOS Service we went to
        JE      GO                      ; intercept?
        JMP     OUT2                    ;No.
GO:     MOV     BX,DX                   ;Yes. Get length of original buffer.
        MOV     CL,BYTE PTR DS:[BX]
        PUSH    DS                      ;Save DS:DX, address of original buffer.
        ASSUME DS:CODE_SEG
        PUSH    CX                      ;Make DS=CX to use local labels.
        POP     DS
        POP     OLD_DS
        PUSH    DS
        POP     OLD_DX
        MOV     BX,888                  ;We will use DS:888 for our buffer.
        MOV     BYTE PTR DS:[BX],CL     ;Store legal length from original buff.
        MOV     BP,BP                   ;Prepare to get IP of return address.
        CMP     FIRST_FLAG,1            ;First time through?
        JNE     NOT_FIRST               ;No -- check if COMMAND.COM is calling.
        MOV     BX,SS:[BP+4]            ;Yes, SHORTHND.COM must have just ended,
        MOV     COMMAND_ADDS,BX         ; so we are at monitor level -- get
        MOV     FIRST_FLAG,0            ; calling addr in COMMAND.COM from stack
        PUSH    AX
        PUSH    CX
        PUSH    DI
        PUSH    ES

        PUSH    CS
        POP     ES
        LEA     DI,PAD
        MOV     CX,3888
        MOV     AL,' '
REP     STOSB
        LEA     DI,PAD
        MOV     AL,'1'
        MOV     CX,5
LLOOP:  MOV     BYTE PTR [DI],'_'
        MOV     [DI+599],AL
        INC     AL
        ADD     DI,688
        LOOP    LLOOP

        POP     ES
        POP     DI
        POP     CX
        POP     AX

        JMP     INTERCEPT       ;Since we are at monitor level, intercept.
NOT_FIRST:                      ;Not the first time through, check COMMAND addr.
        MOV     BX,SS:[BP+4]            ;Get ret addr from stack.
        CMP     BX,COMMAND_ADDS         ;Compare to what we know is COMMAND.COM
        JE      INTERCEPT               ;If not equal, not at monitor level.
        JMP     OUT2                     ;If not equal, not at monitor level.
INTERCEPT:              ;We are at monitor level, check for keys being typed.
        MOV     DX,888          ;Get typein to DOS buffer instead of COMMAND's.
        MOV     AH,8AH          ;Use Service 8AH.
        PUSHF           ;CALL INT 21 (we would intercept and INT 21 instruction)
        CALL    INT21
        PUSHF                   ;Save flags.
        CLD                     ;Set upward flag for string commands.
        PUSH    CS              ;Set ES to CODE_SEG.
        POP     ES

        LEA     DI,88Y1         ;Start by checking for 88Y1.
        MOV     SP,DI           ;BP will hold address of current 88Y.
        MOV     AX,3    ;Loop over 3 keys.
CMPLOOP:MOV     SI,82B          ;Point to the read-in string.
        MOV     Be,81B          ;Get its length.
        XOR     CX,CX           ;Use CX as counter for REPE.
        MOV     CL,BYTE PTR [Be]
        CMP     CL,8            ;If nothing typed, skip the checking.
        JNG     QIB
        CMP     CL,4            ;If more than 4 characters typed, skip also.
        JG      QIX
BBPE    CMPSB                   ;Compare type-in to key.
        JNE     SHXT            ;If zero flag not set, last char didn't match.
        JCXZ    MAYBE           ;All chars matched. Was it the right length?
        JMP     SHORT NEXT
MAYBE:  CMP     BYTE PTR [DI],88 ;If next char is key is <cr>, end of key, so
        JB      FOUND           ;typed-in string was the right length.

NEXT:   ADD     SP,5            ;Point to next key.
        MOV     DI,BP           ;Fill DI, which changes in REPE CMPSB, from SP.
        DEC     AH              ;BP, unlike DI, will always hold key addr.
        JNE     CMPLOOP         ;If AH is 8, have checked all keys.
        JMP     SHORT   SHORT QIB
;SEND <CR> AND WRITE FILE - 40 BYTES, THEN <CR><LF> AT A TIME.
FOUND:  MOV     AH,9
        LEA     DX,CX           ;First send a <CR><LF> to monitor.
        PUSHF
        CALL    INT21

        LEA     SP,CM
        MOV     AH,3CH
        LEA     DX,FILENAME
        MOV     CX,8
        PUSHF
        CALL    INT21
        MOV     CX,75
        MOV     BX,AX   ;Get file handle in BX.
        LEA     DX,PAD
FILE_LOOP:
        MOV     AH,48H
        PUSH    CX

        MOV     CX,48
        PUSHF
        CALL    INT21   ;Write one line.
        PUSH    DS
        LEA     DX,CM
        MOV     CX,2
        MOV     AH,48H
        PUSHF
        CALL    INT21   ;Write <CR><LF>
        POP     DX
        ADD     DX,40
        POP     CX
        LOOP    FILE_LOOP

        MOV     AH,3EH
        PUSHF
        CALL    INT21
        MOV     AH,9
        LEA     DX,FILE_DONE
```

(Figure 1 continues)

```
        PUSHF
        CALL    INT21

        POPF
        JMP     SHORT   $ENDCH

QIK:    MOV     BP,82H-5        ;No match, point to typed in command.
;FOUND:  POPF    ;If there was a match, add 5 to BP to get command addr.
        POPF    ;If there was a match, add 5 to BP to get command addr.
        ADD     BP,5
$ENDCH: PUSH    OLD_DS          ;Now use MOVSB to move command to COMMAND buffer
        POP     ES
        MOV     DI,OLD_DX       ;Get DX of DS:DX.
        ADD     DI,2            ;Point to where type-in is to go.
        MOV     SI,BP
        MOV     AL,0            ;AL will hold char count.
FILL:   MOVSB                   ;Move char to COMMAND.
        CMP     BYTE PTR [SI-1],0DH     ;Reached the command's end?
        JE      FINFIL                  ;Yes.
        INC     AL                      ;No, inc char count.
        JMP     FILL                    ;Loop again.
FINFIL: MOV     DI,OLD_DX               ;Done will string move.
        INC     DI                      ;Give COMMAND char count ie its buffer.
        MOV     BYTE PTR ES:[DI],AL
        POP     CX                      ;The POPs.
        POP     BX
        POP     AX
        POP     BP
        POP     DS
        POP     ES
        IRET                            ;Finish with IRET.
OUT2:   POP     CX                      ;The POPs for the case where we don't
        POP     BX                      ; handle Service 0AH.
        POP     AX
        POP     BP
        POP     DS
        POP     ES
        ASSUME  DS:NOTHING
        JMP     INT21                   ;Let INT 21H take over.
DOS_WATCH       ENDP

PAD     LABEL BYTE

LOAD_PAD        PROC    NEAR    ;This procedure initializes everything
        ASSUME  DS:ROM_BIOS_DATA        ;Examine the char just put in
        MOV     BX,ROM_BIOS_DATA
        MOV     DS,BX
        LEA     DX,PAD
        MOV     PAD_REGIR,DX
        MOV     PAD_CURSOR,DX
        MOV     PAD_OFFSET,DX
        MOV     CX,DX
        ADD     CX,599
        MOV     PAD_END,CX
        MOV     CX,5
        MOV     BX,0
CLOOP:  MOV     CURSOR_STORAGE[BX],DX
        ADD     DX,608
        ADD     BX,2
        LOOP    CLOOP

        ASSUME  DS:INTERRUPTS   ;The data segment will be the Interrupt area
        MOV     AX,INTERRUPTS
        MOV     DS,AX

        MOV     AX,KEYBOARD_INT         ;Get the old interrupt service routine
        MOV     OLD_KEY_INT,AX      ;address and put it into our location
        MOV     AX,KEYBOARD_INT[2]      ;OLD_KEYBOARD_INT so we can call it.
        MOV     OLD_KEY_INT[2],AX

        MOV     KEYBOARD_INT,OFFSET NEWPAD  ;Now load the address of our notepad
        MOV     KEYBOARD_INT[2],CS          ;routine into the keyboard interrupt


        MOV     AX,DOS_INT          ;Get the old interrupt service routine
        MOV     OLD_DOS_INT,AX      ;address and put it into our location
        MOV     AX,DOS_INT[2]       ;OLD_DOS_INT so we can call it.
        MOV     OLD_DOS_INT[2],AX

        MOV     DOS_INT,OFFSET DOS_WATCH  ;Now load the address of DOS_Watch
        MOV     DOS_INT[2],CS         ;routine into the interrupt vector.

        MOV     AH,15                   ;Ask for service 15 of INT 10H
        INT     10H                     ;This tells us how display is set up
        SUB     AH,40                   ;Move to twenty places before edge
        SHL     AH,1                    ;Mult by two (char & attribute bytes)
        MOV     BYTE PTR FIRST_POSITION,AH      ;Set screen cursor
        MOV     STATUS_PORT,03DAH       ;Assume this is a monochrome display
        TEST    AL,4                    ;Is it?
        JNE     EXIT                    ;Yes - jump out
        MOV     SCREEN_SEG_OFFSET,8000H ;No - set up for graphics display
        MOV     STATUS_PORT,03DAH

EXIT:   MOV     DX,OFFSET LOAD_PAD      ;Set up everything but LOAD_PAD to
        ADD     dx,4200
        INT     27H                     ;stay and attach itself to DOS
LOAD_PAD        ENDP

        CODE_SEG        ENDS

        END     FIRST   ;END "FIRST" so 8088 will go to FIRST first.
```

(Figure 1 ends)

do a SAVE, the new PAD.TXT will overwrite your existing file.

BASIC CUSTOMIZING When you run PAD.BAS, the program asks which key you want to use as the trigger. After you install PAD by running PAD.COM, this is the key that will pop up the pad on the screen. Just type the key you want to use (like F10 or Ctrl-P). PAD.BAS will read the codes that key generates in the keyboard buffer and put them into the code of PAD.COM itself. Don't use one of the keys that PAD itself uses (F1, F2, Del, PgUp, PgDn, Backspace), because if you do you'll turn the pad back off whenever you try to use that function.

After entering your choice for a hot key, PAD.BAS will then ask you what "attribute" you want to use for the pad. This is where you select the colors the pad will appear in when first used. If you have a monochrome screen, the best choice is probably simple reverse video, black on white. If this is the choice you want, you don't have to give PAD.BAS any number here at all—just type a carriage return. If you have a color screen, you can select both foreground (letters) and background (the pad) colors. To do this, you just have to add some numbers to produce the attribute you want. Here's the list of background and foreground colors you can add together to make the attribute number you type to PAD.BAS:

Number	Color	
64	Red	Background
32	Green	Background
16	Blue	Background
8	"Bright"	Foreground
4	Red	Foreground
2	Green	Foreground
1	Blue	Foreground

For example, to make a pad with red letters against a blue background, add 4 and 16 to make 20. When PAD.BAS asks you for the attribute of the pad, type 20<Enter>. You can mix colors too. For example, to get a lively display of green letters on a purple background, add a red background (64) and a blue background (16) together, and then add in the green foreground (2) to make 82.

Since this is light and not paint we're adding together, remember that you make yellow by adding red and green. To make "bright," or intense, yellow, add in 8, which intensifies the foreground color and often makes the letters easier to read. In fact, the recommended color setting for the pad is bright yellow letters (2+4+8) on a blue background (16), which adds up to attribute 30. Once you have typed both the trigger key and the attribute number in PAD.BAS, running that program once in BASIC makes the installable PAD.COM for you from the data in the DATA statements.

HOW DOES IT WORK? PAD works in a rather straightforward way. The PC has a screen buffer that holds all the characters (and their attributes) at a particular location in memory. The ASCII values of these characters are read by the video controller in your PC, which flashes them on the screen. Since whatever is in the 2000 bytes that make up the screen buffer goes on the screen, PAD just has to put its display in the screen buffer to get it displayed. The program that is then running is not disturbed by this simple procedure, because all we've done is to move bytes around in the memory used by the video controller—as far as the program is concerned, nothing is different.

After the display is up, PAD has to start intercepting the characters you type before

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■ PROGRAMMING/UTILITIES

```
10      DIM SUMS(17):FOR I=1 TO 16:KEY I,"":NEXT I:CLS:D=330:PRINT "Checking..."
20      FOR I=1 TO 17:READ SUMS(I):NEXT I
30      FOR I=1 TO 17:SUM=0:FOR N=1 TO 80:READ BYTE.%:SUM=SUM+BYTE.%:NEXT N
40      IF SUM<>SUMS(I) THEN PRINT "ERROR BETWEEN LINES",D+100*(I-1),D+100*I:END
50      RESTORE 330:CLS
60      LOCATE 16,15:PRINT" Type the key to turn the pad on and off."
70      LOCATE 11,15:PRINT"  (Use another key if there is no response)."
80      DEF SEG = &H40
90      FREYS=INKEYS:IF FREYS="" GOTO 90
100     LOCATE 10,15:PRINT SPC(50):LOCATE 11,15:PRINT SPC(50)
110     TAIL=PEEK(26):TAIL=TAIL-2:IF TAIL < 30 THEN TAIL = 60
120     CODE1=PEEK(TAIL):CODE2=PEEK(TAIL+1):CLS:LOCATE 10,12
130     PRINT"An attribute of 30 is recommended on color screens.":LOCATE 11,10
140     INPUT"What is the pad attribute(<cr> =default, monochrome screen)";ATTR
150     IF ATTR   0 THEN ATTR = 112
160     CLS:OPEN "PAD.COM" AS 4 1 LEN = 1          'Open Pad.Com
170     LOCATE 2,30:PRINT"   Creating PAD.COM      "
180     FIELD 41,1 AS BYTE.$:FOR N = 1 TO 1432
190     READ BYTE.%
200     IF BYTE.% <> -1 THEN GOTO 220
210     LSET BYTE.$=CHR$(ATTR):PUT 41:GOTO 270
220     IF BYTE.% <> -2 THEN GOTO 240
230     LSET BYTE.$=CHR$(CODE1):PUT 41:GOTO 270
240     IF BYTE.% <> -3 THEN GOTO 260
250     LSET BYTE.$=CHR$(CODE2):PUT 41:GOTO 270
260     LSET BYTE.$ = CHR$(BYTE.%):PUT 41
270     NEXT N:CLOSE 41
280     LOCATE 19,15:PRINT SPC(10) "      PAD.COM Created.                 "
290     END
300     DATA   5775,   3823,   6639,   6343,   6480,   7271,   7807,   7275
310     DATA   6215,   7051,   7746,   7272,   7126,   8255,   7665,   7692
320     DATA   6679
330     DATA    133,    249,      4,     67,    111,    112,    121,    114
340     DATA    105,    103,    104,    116,     32,     49,     57,     56
350     DATA     55,     12,     90,    105,    102,    102,     45,     60
360     DATA     97,    110,    105,    115,     32,     80,    117,     90
370     DATA    108,    105,    115,    104,    105,    110,    103,     32
380     DATA     47,    111,     46,      0,      0,      0,      0,      1
390     DATA      0,      0,      1,      0,      1,     16,     83,     65
400     DATA     86,     69,     13,    115,     97,    110,    101,     13
410     DATA     63,     97,    110,    101,     13,     10,     36,     13
420     DATA     10,     80,     65,     68,     46,     84,     80,     84
430     DATA     32,     69,    114,    101,     97,    116,    101,    100
440     DATA     46,     13,     10,     36,      0,      0,     60,     65
450     DATA     66,     46,     44,     68,     84,      0,      0,      0
460     DATA      0,      0,     80,      2,    176,      4,      0,      7
470     DATA     96,      9,      0,      0,      0,      0,     87,      2
480     DATA      0,      9,      0,      0,     -1,      0,      0,      0
490     DATA      0,      0,      0,      0,      0,      0,      0,      0
500     DATA      0,     80,     83,     91,     82,     87,     86,     30
510     DATA      6,    154,     46,    255,     30,    133,      1,    107
520     DATA     64,      0,    142,    219,    139,     30,     20,      0
530     DATA     59,     30,     26,      0,    116,     67,    131,    235
540     DATA      2,    129,    251,     30,      0,    115,      6,    107
550     DATA     62,      0,    131,    235,      2,    139,     23,    129
560     DATA    -56,     -2,     -3,    117,     80,    137,     30,     20
570     DATA      0,      0,     46,    247,      1,     22,     92,      1
580     DATA     62,     92,      1,      0,    117,     30,    141,     22
590     DATA    252,      5,     44,    137,     22,    114,      1,     46
600     DATA    129,      6,    114,      1,    164,     11,    141,      6
610     DATA     54,      4,     46,    163,    129,      1,    232,    155
620     DATA      2,    233,    192,      1,    141,     22,    252,      5
630     DATA     44,    137,     22,    114,      1,     46,    120,      6
640     DATA    114,      1,    180,     11,    141,      6,     11,      4
650     DATA     46,    163,    126,      1,    232,    125,      2,    232
660     DATA    171,      1,    233,    159,      1,     46,    247,      6
670     DATA     92,      1,      1,      0,    116,    211,    137,     30
680     DATA     20,      0,    129,    250,      0,     83,    117,     40
690     DATA     30,     14,     31,     46,    139,     30,    110,      1
700     DATA     75,    168,      7,     32,     75,     46,     59,     30
710     DATA    116,      1,    117,    245,    198,      7,     95,     46
720     DATA    139,     22,    116,      1,     46,    137,     22,    102
730     DATA      1,     31,    232,    112,      1,    233,    100,      1
740     DATA    129,    250,      0,    114,    117,     43,     30,     14
750     DATA     11,     46,    139,     30,    102,      1,     46,     59
760     DATA     30,    116,      1,    126,     19,    190,     71,    255
770     DATA     95,     46,    255,     14,    102,      1,     46,     59
780     DATA     30,    116,      1,    116,      3,    190,      7,     32
790     DATA     31,    232,     65,      1,    233,     53,      1,    129
800     DATA    250,     13,     20,    117,     13,     30,     14,     31
810     DATA    232,     74,      1,     31,    232,     46,      1,    233
820     DATA     34,      1,    129,    250,      0,     73,    117,     70
830     DATA     46,    131,     62,    120,      1,      0,    117,      3
840     DATA    233,     17,      1,     46,    139,     30,    120,      1
850     DATA      1,    219,     46,    136,     14,    102,      1,     46
860     DATA    137,    143,    104,      1,     46,    255,     14,    128
870     DATA      1,    111,    235,      2,     46,    136,    143,    104
880     DATA      1,     46,    117,     14,    102,      1,     46,    161
890     DATA    128,      1,    107,     80,      2,    247,    227,    141
900     DATA     22,    252,      5,      3,    194,     46,    163,    110
910     DATA      1,      5,     87,      2,     46,    163,    110,      1
920     DATA    232,    210,      0,    233,    206,      0,    129,    250
930     DATA      0,     61,    117,     78,     44,    131,     62,    120
940     DATA      1,      4,    117,      3,    233,    169,      0,     46
950     DATA    139,     30,    120,      1,      3,    219,     46,    139
960     DATA     14,    102,      1,     46,    137,    143,    104,      1
970     DATA     44,    255,      6,    128,      1,    131,    195,      2
980     DATA     46,    139,    143,    104,      1,     46,    137,     14
990     DATA    102,      1,     46,    161,    128,      1,    107,     80
1000    DATA      2,    247,    227,    141,     22,    252,      5,      3
1010    DATA    194,     46,    163,    116,      1,      5,     87,      2
1020    DATA     46,    161,    116,      1,    232,    134,      0,    235
1030    DATA    123,    144,    129,    250,      0,     59,    117,     36
1040    DATA     46,    138,     38,    125,      1,    254,    196,    128
1050    DATA    252,     16,    124,      2,    100,      0,     46,    136
1060    DATA     30,    125,      1,     46,    128,     30,    124,      1

1070    DATA    240,     40,      0,     38,    124,      1,    232,     92
1080    DATA      0,    235,     81,    144,    126,    250,      0,     80
1090    DATA    117,     37,     46,    138,     38,    126,      1,    128
1100    DATA    196,     10,    128,    252,    128,    114,      2,    180
1110    DATA      0,     46,    138,     38,    128,      1,     46,    120
1120    DATA     30,    124,      1,     15,     46,      8,     30,    124
1130    DATA      1,    232,     49,      0,    235,     30,    144,     30
1140    DATA     14,     31,     46,    139,     30,    102,      1,     46
1150    DATA     59,     30,    110,      1,    125,     10,    136,     23
1160    DATA     40,    255,      0,    102,      1,     87,     46,     59
1170    DATA     30,    110,      1,    116,      3,    190,      7,     95
1180    DATA     31,    232,      9,      0,      7,     31,     94,     95
1190    DATA     90,     89,     91,     88,    207,     88,     46,    255
1200    DATA     54,    110,      1,     48,    143,      6,    114,      1
1210    DATA    141,      8,     54,      4,     48,    103,    129,      1
1220    DATA    232,    105,      0,     88,    195,     48,    139,     62
1230    DATA    110,      1,    131,    239,     48,     46,     57,     62
1240    DATA    102,      1,    125,     48,     48,    139,     30,    102
1250    DATA      1,    139,    165,     46,     43,      6,    116,      1
1260    DATA     61,     39,      0,    116,     17,    124,      5,     45
1270    DATA     48,      0,    235,    244,    198,      7,     32,     46
1280    DATA    255,      6,    102,      1,    235,    222,    199,      7
1290    DATA     32,    198,     71,      1,     95,     46,    255,      6
1300    DATA    102,      1,    195,     30,     82,     14,     31,    199
1310    DATA      2,      0,     48,    139,     22,    131,      1,    236
1320    DATA    100,      1,    117,    251,    230,    160,      1,    110
1330    DATA    251,     38,    130,     37,     71,     78,    131,    254
1340    DATA      0,    116,      4,    138,     39,    235,    232,     87
1350    DATA    136,     39,     67,     90,     31,    195,     30,     81
1360    DATA     82,     14,     31,    130,     39,    190,      2,      0
1370    DATA     46,    139,     22,    131,      1,    236,    100,      1
1380    DATA    117,    251,    236,    160,      1,    116,    251,     30
1390    DATA    136,     37,    141,     14,    252,      5,    129,    193
1400    DATA    104,     11,     46,     57,     14,    114,      1,    117
1410    DATA      5,    130,    103,      1,    235,      5,     46,    130
1420    DATA     30,    124,      1,     71,     78,    117,    214,     67
1410    DATA    141,     14,    252,      5,    129,    193,    104,     11
1440    DATA     46,     57,     14,    114,      1,    117,      1,     67
1450    DATA     90,     89,     31,    195,    107,      0,    170,    142
1460    DATA    195,     46,    136,     62,    127,      1,     46,      3
1470    DATA     62,    122,      1,     46,    139,     30,    114,      1
1480    DATA    105,     15,      0,    106,     48,      0,     46,    255
1490    DATA     22,    129,      1,     74,    117,    240,     46,      3
1500    DATA     62,    122,      1,    226,    230,    195,      6,     30
1510    DATA     95,     88,     83,     81,    120,    252,     10,    116
1520    DATA      3,    233,     53,      1,    139,    210,    130,     15
1510    DATA     30,     14,     31,    143,      6,     50,      1,     82
1540    DATA    143,      6,     52,      1,    107,    128,      0,    136
1550    DATA     15,    139,    236,    120,     62,     47,      1,      1
1560    DATA    117,     60,    139,     94,      4,    137,     30,     48
1570    DATA      1,    198,      6,     47,      1,      0,     88,     81
1580    DATA     87,      6,     14,      7,    141,     62,    252,      5
1560    DATA    105,    104,     11,    176,     32,    243,    170,    141
1600    DATA     62,    252,      5,    176,     49,    105,      5,      0
1610    DATA    160,      5,     95,    136,    133,     87,      2,    254
1620    DATA    162,    126,    166,     88,      2,    226,    241,      7
1630    DATA     95,     89,     86,    235,     13,    144,    139,     94
1640    DATA      4,     59,     38,     49,      1,    116,      3,    233
1650    DATA    207,      8,    106,    128,      0,    100,     10,    156
1660    DATA    255,     38,     43,      1,    156,    252,    114,      7
1670    DATA    141,     62,     54,      1,    139,    239,    104,      3
1690    DATA      9,    199,    130,      0,    107,    129,      0,     51
1660    DATA    201,    130,     15,    120,    249,      0,    126,    120
1700    DATA    120,    249,      4,    127,    115,    243,    166,    117
1710    DATA      9,    227,      2,    235,      5,    120,     61,     13
1720    DATA    116,     10,    131,    197,      5,    139,    253,     72
1730    DATA    117,    215,    235,     92,    100,      9,    141,     22
1746    DATA     60,      1,    156,    255,     30,     43,      1,    141
1750    DATA     40,     80,      1,    100,     60,    141,     22,     94
1760    DATA      1,    105,      0,      0,    156,    255,     30,     43
1770    DATA      1,    105,     75,      0,    139,    216,    141,     22
1780    DATA    252,      5,    100,     64,     81,    105,     40,      0
1790    DATA    156,    255,     30,     43,      1,     82,    141,     22
1800    DATA     60,      1,    105,      2,      0,    100,     64,    156
1810    DATA    255,     30,     43,      1,     90,    131,    194,     48
1820    DATA     89,    226,    223,    100,     62,    156,    255,     30
1830    DATA     43,      1,    100,      9,    141,     22,     71,      1
1840    DATA    156,    255,     30,     43,      1,    157,    235,      7
1850    DATA    189,    125,      0,    157,    131,    197,      5,    255
1860    DATA     54,     50,      1,      7,    139,     62,     52,      1
1870    DATA    131,    169,      2,    139,    245,    176,      0,    164
1880    DATA    120,    124,    255,     13,    116,      4,    254,    192
1890    DATA    235,    245,    139,     62,     52,      1,     71,     30
1900    DATA    136,      5,     89,     91,     88,     93,     31,      7
1910    DATA    207,     89,     91,     88,     93,     31,      7,     46
1920    DATA    255,     40,     43,      1,    107,     64,      0,    142
1930    DATA    219,    141,     22,    252,      5,     46,    137,     22
1940    DATA    110,      1,     46,    137,     22,    102,      1,     46
1950    DATA    137,     22,    114,      1,    139,    202,    129,    193
1960    DATA     87,      2,     46,    137,     14,    110,      1,    105
1970    DATA      5,      0,    107,      0,      0,     46,    137,    151
1980    DATA    104,      1,    129,    194,     88,      2,    131,    195
1690    DATA      2,    226,    242,    104,      0,      0,    142,    216
2000    DATA    161,     36,      0,     46,    163,    133,      1,    161
2010    DATA     36,      0,     46,    163,    135,      1,    199,      6
2020    DATA     36,      0,    137,      1,    140,     14,     30,      0
2030    DATA    161,    132,      0,     46,    163,     43,      1,    161
2046    DATA    134,      0,     46,    163,     45,      1,    169,      6
2050    DATA    132,      0,    174,      4,    140,     14,    134,      0
2066    DATA    100,     15,    205,     16,    128,    236,     40,    200
2070    DATA    228,     46,    136,     38,    122,      1,     46,    199
2080    DATA      6,    131,      1,    106,      3,    160,      4,    117
2090    DATA     14,     46,    199,      6,    127,      1,      0,    128
2106    DATA     46,    199,      6,    131,      1,    210,      3,    106
2110    DATA    252,      5,    129,    194,    104,     16,    205,     39
```

Figure 2: *A BASIC program that will create PAD.COM and give you the opportunity to change the program defaults.*

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CIRCLE 203 ON READER SERVICE CARD

■ PROGRAMMING/UTILITIES

the current program can read them. PAD does this by attaching itself to the keyboard interrupt, a program that is run every time a key is typed. When you type a key, the PC reads it and puts it into the keyboard buffer. If the PAD display is on, PAD takes the character just typed out of the keyboard buffer, resets the buffer, and puts the character on the screen. By the time the program you're running gets a look at the keyboard buffer, it's empty again, so it reads nothing.

In this way PAD takes control of the PC. When you type the trigger key again, PAD restores the original bytes in the screen buffer so it looks as though the PAD vanishes, and stops intercepting keystrokes. The program you've been running apparently "turns on" again, though, of course, it's been active all the time.

■ At the DOS command level, PAD checks to see if you've entered the word SAVE.

When you're at the DOS command level, PAD does one more thing: it checks to see if you've entered the word SAVE. When you do, it dumps the contents of the pad into the text file PAD.TXT on disk. Normally, if you recall, it is the program COMMAND.COM that reads the commands you've typed. Here, PAD.COM intercepts and reads the command before COMMAND.COM gets the chance. This process is also not very hard. DOS channels everything you type at its prompt into a buffer in memory so that COMMAND can read it. All that PAD does is to set up its own buffer and make sure that the typed characters go there instead. When you're done with the current command, i.e., after you hit Enter, PAD reads what you've typed. If it's SAVE (or save or Save), it dumps the pad into PAD.TXT and then makes COMMAND.COM think you've just pressed Enter. On the other hand, if you've typed a DOS command, PAD writes what you've typed into COMMAND's buffer and gives it control, just as DOS does. To COMMAND.COM, there is no difference whatsoever. This procedure has the startling effect of appearing to make SAVE a bona fide DOS command—a procedure I'll exploit more in further utilities to come. PC

Steve Holzner is a longtime contributor to the Programming/Utilities column.

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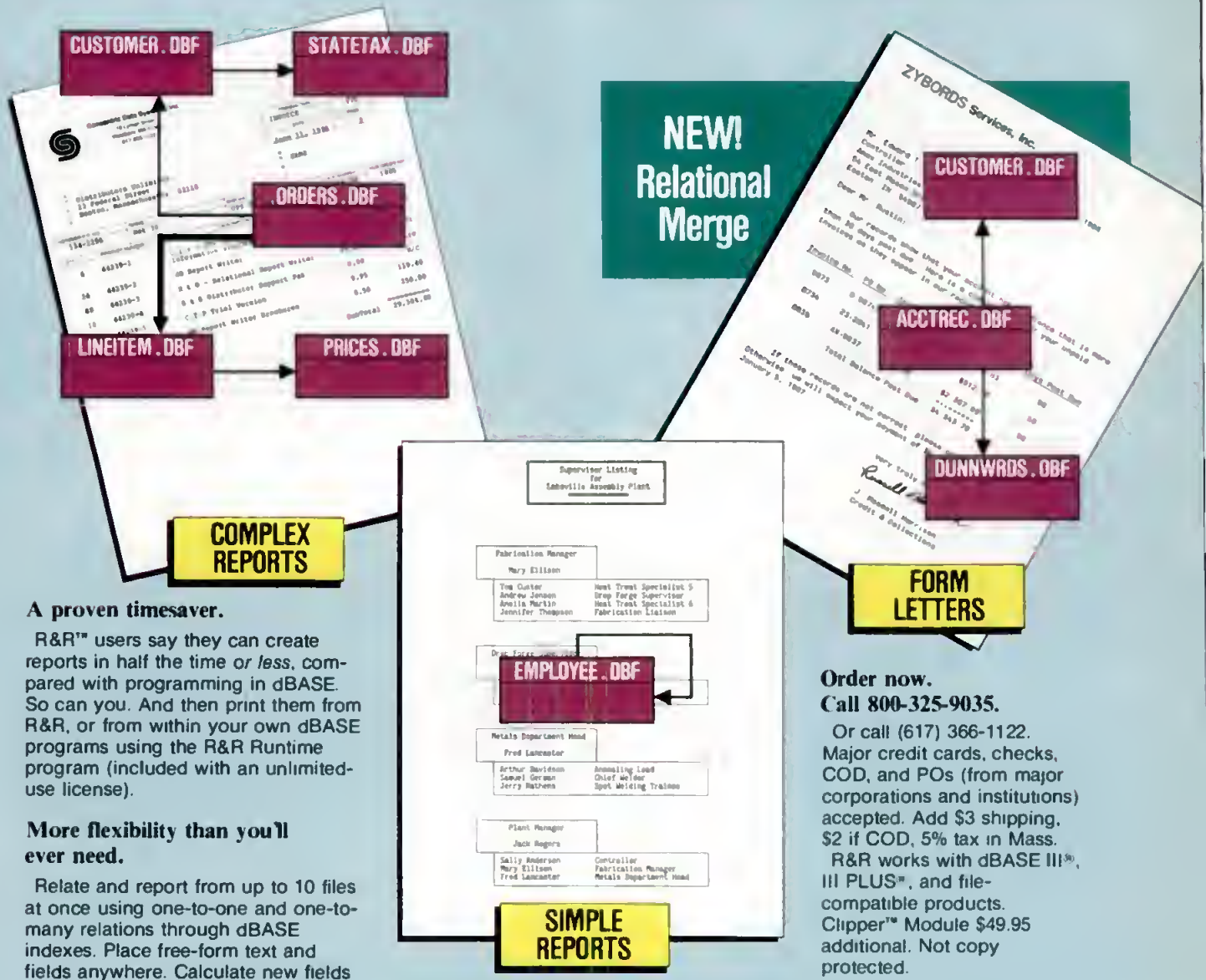

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■ JARED TAYLOR

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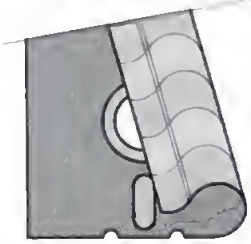

Loading Release 1A with speed and ease; 1-2-3 and Symphony problems with @if; faster macros in Release 2; Fast SuperCalc graphics printing; reformatting dates.

1-2-3 PUZZLER

The spreadsheet shown in Figure 1 shows a strange inconsistency in the way *1-2-3* and *Symphony* handle the @if function. Both "Display" figures in column C are set up identically, as their formulas (shown to their right) demonstrate. In the top one, C7 is the formula 333 − C6, so the sum of C6 and C7 must be equal to 333, or the value in C4. The formula in C9 is set up to display a 1 if the sum of C6 and C7 equals C4, and to display a 0 if it does not. Strangely enough, however, the value in C9 is 0, which means that the sum of C6 and C7 is not equal to 333.

Some values of C6 will result in the 1 in cell C9 that you would expect. Whole numbers, for example, show a 1. Also, as is shown in the lower example in the same figure, certain decimals will give the correct results. If C6 ends in .25, .5, or .75, C9 will display a 1 instead of a 0. If you enter various numbers into C6, you will see this inconsistency in action. What's going on here, anyhow?

Steve Barber
Manassas, Virginia

Beats me. Let's hope that one of the fine minds that read this column will write in with an explanation.

	C	D	E	F
1				
2	DISPLAY		FORMULA	
3				
4	333		333	
5				
6	23.26		23.26	
7	309.74		333-C6	
8	=========		=========	
9	0		@IF(@SUM(C6..C7)<>C4,0,1)	
10				
11				
12	333		333	
13				
14	23.25		23.25	
15	309.75		333-C14	
16	=========		=========	
17	1		@IF(@SUM(C14..C15)<>C12,0,1)	
18				

Figure 1: *A puzzling inconsistency in the way Lotus products handle an @if formula.*

GRAPHING WITH SUPERCALC

I often print graphs from *SuperCalc* on an Epson RX-100 printer. When I print in quad density, I get good-looking graphs and tables that photocopy well, but it takes a long time to print them. If I'm working with a new format or change the size of my paper and I'm not sure how a graph is going to look, I can save time by printing a first draft in single density. I do this by setting the /Global Graphics Options menu's printer RESOLUTION entry to S. This cuts the print time for a half-page graph from 7½ to 2½ minutes. When I'm sure the graph looks right, I switch back to quad density, save the menu settings, and print presentation copies.

Jeff Kestel
Ithaca, New York

This is good advice for any time-consuming graphics printing routine when you're not sure how the results will look. It's especially important if you don't have a graphics monitor that lets you check how your graphs will look before you actually print them out.

PAINLESS ENTRY

After using Release 1A of *1-2-3* for a while, it got to be a pain to wait for the copyright screen and then press a key to get into the program. Here is a DEBUG patch that eliminates the call to the copyright screen, so that the program can be loaded in one step.

First, make sure that 123.EXE and DE-

SHEET CLINIC

BUG.COM are on the same floppy diskette or are located in the same directory of your hard disk.

Since DEBUG won't write to an .EXE file, you must now rename the program to something like 123.TMP. At the DOS prompt, enter the commands below. Note that in this notation, <Enter> means hit the Enter (Return) key:

```
DEBUG 123.tmp<Enter>
```

DEBUG will respond with its prompt, which is a dash or hyphen. Now enter the following command:

```
e cs:04c8<Enter>
```

DEBUG will respond with a string of numbers. At that point, enter the following sequence:

```
90 90 90<Enter>
```

Each time that you hit the Spacebar, DEBUG will add a few numbers to the line. Just keep going and end with Enter. DEBUG will respond with its hyphen prompt, at which point you enter

```
w<Enter>
```

DEBUG tells you how many bytes it is writing and then returns to the hyphen prompt. You hit

```
q<Enter>
```

Rename 123.TMP back to 123.EXE, and you can run *1-2-3* without having to hit a key to get past the copyright screen.

Cecil Bingham
Kissimee, Florida

Patches that do this have been around for some time, and this one works fine. Having to hit a key to get past the copyright screen was not just a nuisance. It meant that you couldn't write totally automated applications that included 1-2-3. *Some programmers wrote routines that called* 1-2-3 *with a batch file and then went on to run AUTOEXEC macros. That silly keystroke requirement meant that somebody had to come by and hit a key in order for* 1-2-3 *to run. KEY-FAKE.COM (in our Programming/Utilities column, Volume 4 Number 26) offered a way out, but patching past the copyright screen is by far the best solution.*

Lotus must have gotten a lot of flak about that keystroke; it was eliminated from Release 2.

FORMAL DATE NOTATION

It would be nice to be able to make dates appear in *1-2-3* in the conventional format of July 4, 1987 rather than the informal style of 4-Jul-87. I've written a macro, shown in Figure 2, that writes today's date in a more formal style. The formula covers several lines in the figure, but it should, of course, be entered continuously into a single cell.

Barry DeGraff
Palm Bay, Florida

If you put a cell address in the formula instead of @now, the formula will display the date corresponding to whatever number is in the referenced cell. However, any number that should give you a date before 1910 will be displayed incorrectly. 1901 will display as 191, 1905 as 195, etc., because the @year function does not return leading zeros.

KEEP IT SIMPLE

Mr. Bob Clark's "More Menu Choices" submission to Spreadsheet Clinic (Volume 6 Number 2) was the most useful Lotus suggestion I have ever read. To me it was worth the price of my yearly subscription to *PC Magazine*.

I sure had to work for it, however. The macro had a blank row in it, with the word BLANK to the left. I researched the BLANK command in the *1-2-3* manual, wasting 15 minutes on that blind alley, and was about to give up in disgust. Finally, I recalled reading about a macro in another magazine in which the author was not so cryptic. He had actually taken a dozen words to say that BLANK was the range name of the blank cell in the macro. That was the closely held secret. I tried that, and of course it worked.

I have no doubt that among you spreadsheet specialists, it is a de facto standard that the word BLANK in the left column means that you are supposed to give that name to the blank cell to its right. Fine. I understand that *now*, but I may forget it by next year, and there's nothing in the *1-2-3* manual about it.

This is not the first time I have wished to heaven you had added a sentence, or even half a sentence, explaining to us nonspecialists what some of the submissions mean—and often what your own comments mean. For the thousands of ordinary souls who have other things than macro conventions to try to remember, could you find it in your heart to add an extra dozen words of explanation, rather than leave us to work things out like a bloody crossword puzzle? When I really want puzzles to solve, I turn to the journal of the American Cryptogram Association, of which I am a long-standing member.

Robert Babin
Rancho Palos Verdes, California

Yes, it's a de facto convention to identify macro ranges by writing their names in the cell to the left. Mr. Babin is right, however, to complain that this is not a documented standard, but one that has grown up among users. Most of the time when I edit submissions, I remember to add the warning, "Be sure to give the range names in column C to the cells to their right in column D." The reason I have to add that is because the convention is so well known that submission letters never mention it. For experienced readers, advice like that is a little like saying, "When you copy cell A1 to B2, remember to start the command with the slash. . . ."

Of course, not all readers are experienced, and I try to come up with a reasonable mix for the column. Some of the items may seem arcane, but for every letter like Mr. Babin's, I get one that fulminates, "Why on earth did you print that feebleminded routine? I expect to find something new in your column, not stuff I've known for years." Occasionally, I even get letters from people who like the column.

Finally, the point of interest in Mr. Clark's submission was the method as

```
@CHOOSE(@VALUE(@MONTH(@NOW)),"","JANUARY","FEBRUARY","MARCH","APRIL","MAY",
"JUNE","JULY","AUGUST","SEPTEMBER","OCTOBER","NOVEMBER","DECEMBER")&" "&
@STRING(@DAY(@NOW),0)&", 19"&@STRING(@YEAR(@NOW),0)
```

Figure 2: *A* 1-2-3 *formula that displays today's date in formal notation.*

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much as the results. If all you want is a good look at the files on your disk, /fr and then the Name key (F3) will do the job.

SPEEDING UP MACROS

In a recent Spreadsheet Clinic (Volume 5 Number 22) there was a useful tip from a reader who explained that by using {windowsoff} and {paneloff} you can speed up the execution of *1-2-3* macros. Since the program doesn't have to spend so much time updating the screen, it can go about its business quicker.

There are additional ways to speed up macros. One is to use the Release 2 command {blank} instead of the Release 1A routine, /Range Erase. Instead of /reA1~ use {blank A1}, and instead of /reOLDDATA~ use {blank OLDDATA}. I have a macro that has 24 erase commands that are used to update a worksheet before new data entry. I timed its operation with and without {windowsoff}, {paneloff}, and {blank}, and obtained the results shown in Figure 3.

I have also found that macros execute more quickly if you use the {branch} key word rather than the old /xg command.

Gerard Tan
Santa Clara, California

That's quite a speedup Mr. Tan reports for the last example, just by using {blank} instead of /re. When I clocked a few test macros I didn't get anywhere near that *much improvement, but the {blank} macros definitely ran more quickly. For those of us who got started on Release 1A, it's sometimes hard to break old habits, but the newer equivalents in Release 2 are generally faster. I no longer use the old /x commands unless I need to write macros that are 1A compatible.*

WITHOUT	{windowsoff} {paneloff} or {blank}	39	Seconds
With	{windowsoff}	23	
With	{windowsoff} and {paneloff}	21	
With	{windowsoff} {paneloff} and {blank}	10	

Figure 3: *Speed tests of the same macro when run with and without certain commands.*

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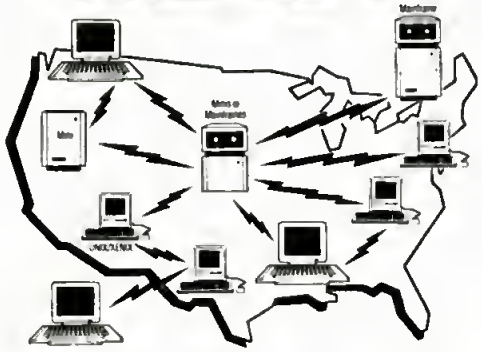

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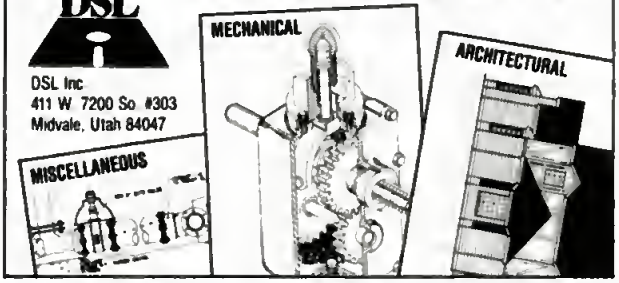

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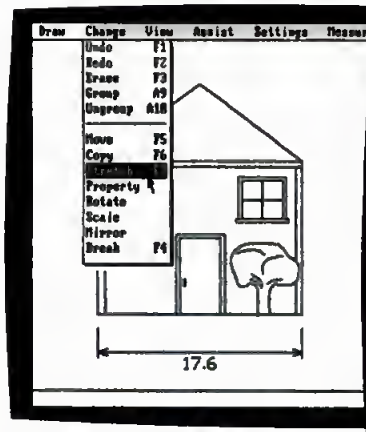
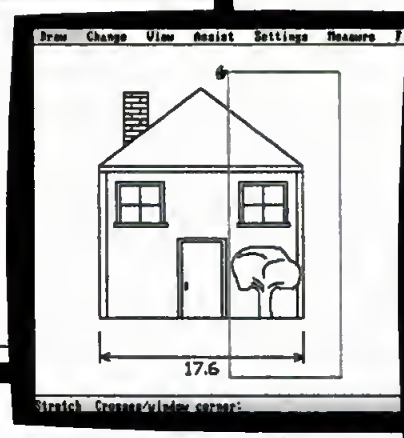
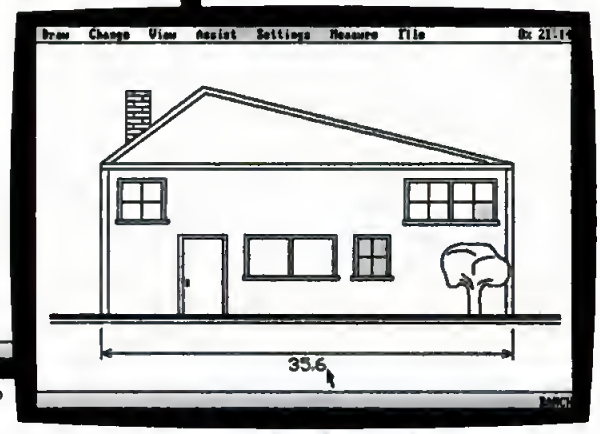


You've drawn your cottage. With your mouse, choose Stretch from the Change menu.



Select the portion of your drawing you want to stretch.



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CONNECTIVITY CLINIC

Networking answers focused on using a Bernoulli Box as a shared drive, file and record locking, remote LAN access, fiber-optic cabling, and the future of ISDN.

SHARING A BERNOULLI BOX

We are running an IBM PC AT as a server under Novell *Advanced NetWare/286* with 3Com EtherLink cards. Can we use an Iomega Bernoulli Box as a shared network drive?

The folks at Novell say no, not at this time. You can run a Bernoulli Box as a drive off of a workstation on the network and use it for backups by downloading files through the network, but support for the Bernoulli Box attached to the server will have to wait for a NetWare *release planned for the third quarter of 1987.*

WHO IS THE KEEPER OF THE LOCK?

We want to create a relatively simple inventory system running under database management software on a LAN. In the documentation for the network version of some database programs, we find instructions on including record and/or file lock calls before any action is taken to write or change data. Other networked database programs don't seem to need these commands. What is going on?

You have discovered the difference between implicit and explicit file and record locking in networked database systems. Implicit locking means the program invokes the lock on a record or file automatically; the programmer doesn't have to remember to lock and unlock the file or record in critical places in the program. Explicit locking means that the programmer must do the job or data is likely to be damaged.

There are reasons for each locking arrangement. Implicit locking sets the lock and holds it until the user leaves the record. This strategy can slow down a busy system because other stations are kept from making changes even if the first station is done writing. However, programming in a system with implicit locking is easier and the risks are less. The explicit system will be a little more efficient under ideal circumstances, but a poorly written program can lead to corrupted data or inefficient operation because too many records or even files are locked by a program at one time.

DIALING INTO THE LAN

Is there any simple way to allow users to dial into a 3Com network (EtherLink boards and *3+Share* software) through a modem without having to buy and install the 3Com remote software? The person who is in charge of the LAN didn't install the system originally and is afraid to make changes to the networking software.

■ When you extend a LAN through remote control, the applications are executed in the host workstation that is local to the server.

There is an answer to dial-in LAN access that is more flexible, faster, and more practical than the software provided by either 3Com or Novell. You don't have to touch the networking software to make it work. The answer I recommend is Carbon Copy II *software from Meridian Technology. I tried the* Carbon Copy II *program as a remote LAN access method almost in desperation after being frustrated by the programs from the network companies. It works beautifully.*

Products like Remote *and* Carbon Copy II *give remote control of a computer through a telephone line. Normally, we think about using* Carbon Copy II *to do things such as running programs on a PC at work from a portable PC on the road.*

It is important to note the difference between extending a LAN with a remote control program and entering into a LAN from a distance with a remote workstation package. When you extend a LAN through remote control, the applications are executed in the host workstation that is local to the server. You can use the host workstation's extended memory and other facilities. Only the screens and keystrokes are sent over the phone lines.

The approach taken by the LAN companies is to make the distant mochine a workstation on the network. You dial into a modem attached to the server and run the applications programs in your own remote CPU and RAM. Program files and data files taken from the server by the remote

■ CONNECTIVITY CLINIC

workstation have to be laboriously drawn through the slow telephone connection.

In some applications, such as using electronic mail, there is little difference in performance. But when you run other applications, like a DBMS, the difference can be great. You get the best efficiency with a remote control program if you avoid screen menus and use batch jobs on the local workstation to initiate tasks.

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ucts have gotten a bit gray around the edges and long in the tooth since then, but now Dennis Hayes is looking to the future again.

ISDN (Integrated Services Digital Network) is an international plan to change all telephones from the analog devices they are today to completely digital systems. In these digital systems (some exist today), electrical voice impulses ure converted to digital zeros and ones right at the bottom of the handset's curly cord. The RJ-11 jack in the wall of your office (and eventually your home) will connect to two 64-kilobit-per-second and one 9.6-kilobit-per-second digital channel. Computers, fax machines, digital phones, and other digital devices all plug directly into an ISDN-compatible RJ-11 jack without a modem.

Note those words, "without a modem." Now do you see why Dennis Hayes is interested in ISDN?

What Dennis is demonstrating is a device that is an interface between the PC's datu bus and the 64-kilobit-per-second channel of ISDN. This interface has to do a lot of things (some of them very modem-like) to move data between the PC and the ISDN channel.

Who needs it? That depends on whom you talk to. The local telephone operating companies (the people who give you dial tone) think ISDN is the wave of the future. Many companies that sell telephone switches, like Northern Telecom and Mitel, feel the same way. But other people think ISDN is another grand scheme that will vaporize in the harsh light of duy. I personally come down on the side that suys money talks and that ISDN can also mean "I Smell Dollars Now." I think Hayes is doing the right thing.

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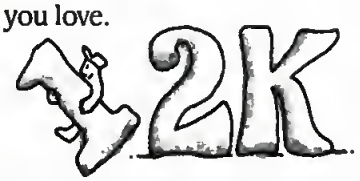

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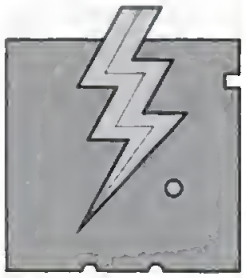

Implementing Newton's method for determining roots; relabeling already-formatted disks; reading protected files in Turbo; two routines that force a reset.

THE ROOT OF THE MATTER

Although Turbo Pascal's SQRT function allows the user to take the square root of a number, there is no predefined function to extract the Nth root. Further, while the BCD version of Turbo provides greater precision, it sacrifices some predefined functions, including SQRT, EXP, and LN. To overcome this limitation, use the function root (A,N), which returns the Nth root of A. A is a real or an integer (either positive or negative), and N is a positive integer. The result is a real.

[*Mr. Peladeau's original root function was another sort of repeated approximation. It generated each new guess by dividing the current guess into the base and taking the average of the guess with that quotient. I replaced it with the program shown in Figure 1 because Newton's method is faster and more widely applicable.—Ed.*]

This function uses Newton's method of repeated approximation. It starts with a guess and repeatedly improves that guess until it reaches the limit of accuracy of the particular Turbo compiler being used. Newton's method can find roots for a wide variety of continuous functions. In this case the function is

$$f(X) = K - X^{\wedge}R$$

where K is the base and R the root. If the current best guess is G, the next guess is $G - (F(G) / F'(G))$. It improves the guess until there is no further change.

Root works equally well in the BCD and 8087 versions of Turbo Pascal. The listing also includes a function called

```
PROGRAM Root_Demo;
VAR
  n      : Integer;
  a      : Real;

  FUNCTION Int_Power(Power : Integer; Ve : Real) : Real;
  VAR
    val : Real;
    i   : Integer;
  BEGIN
    val := va;
    IF Power > 0 THEN
      FOR i := 1 TO (Power-1) DO ve := va*val
    ELSE FOR i := -1 DOWNTO (Power-1) DO va := va/val;
    Int_Power := va;
  END;

  FUNCTION root(va : Real; rt : Integer ) ; Real;
  VAR
    N                          : Integer;
    epsilon, try, prevl, prev2 : Real;

    FUNCTION f(X : Real) : Real;
    BEGIN f := va-Int_Power(rt, X); END;

    FUNCTION f_prime(X : Real) : Real;
    BEGIN f_Prime := -rt*Int_Power(rt-1, X); END;

  BEGIN
    IF rt = 0 THEN root := 1
    ELSE
      IF (NOT(Odd(rt)) AND (ve < 0)) THEN
        BEGIN
          WriteLn(#7, 'ERROR:  no imaginary reaulta allowed here');
          root := 0;
        END
      ELSE
        BEGIN
          try := ve/rt;     {make a guesa}
          prevl := try;
          prev2 := try;
          REPEAT
            epsilon := f(try)/f_prime(try);
            try := try-epsilon;
            IF prev2 = try THEN epsilon := 0; { These linea catch the case }
            prev2 := prevl;                   { of alternating between     }
            prevl := try;                     { two valuea                 }
          UNTIL epsilon = 0;
          root := try;
        END;
  END;                              {function root( va : real;rt: integer);}

BEGIN
  ClrScr;
    REPEAT
      Write('Enter a value   : '); ReadLn(a);
      Write('Root (1 to end) : '); ReadLn(o);
      WriteLn(Root(a, n));
    UNTIL n = 1;
  END.
```

Figure 1: *How to take integer roots of real numbers.*

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CIRCLE 313 ON READER SERVICE CARD

Int_Power which could be used independently if you want to raise a number to an integer power.

Normand Peladeau
Montreal, Quebec
Canada

The root function is invaluable in Turbo BCD, but it does have certain limitations. It will not actually take all integer roots of all real numbers. If the intermediate results are too large, the program will crash, as, for example, when you try to take the 40th root of 1000.

I have included the function ExpLnPower (Figure 2) for comparison. This function will not work under Turbo BCD, but for Turbo-87 and plain Turbo it is much faster.

READ-ONLY RESET

I often have to create read-only files to protect important data files from accidental erasure or alteration. Turbo Pascal cannot read these protected files, however, because its standard Reset() procedure returns I/O error 01—File does not exist—when a read-only file is Reset. The solution I recommend is to use the procedure ResetRO shown in Figure 3.

The Reset procedure opens the file via DOS (if it is not open already), saves the file handle at offset 0 in the FIB, sets the flag byte at FIB+2 for an input only file, sets the buffer size at FIB+6, and sets the buffer pointer (FIB+8) and the buffer end (FIB+10) to the value of the buffer offset (FIB+4). ResetRO mimics the operations that Reset performs on this block and cor-

```
function ExpLnPower(base, exponent : real):real;
BEGIN
  IF base < 0 THEN base := - base;
  IF base = 0 THEN ExpLnPower := 0
    ELSE
      ExpLnPower := exp(exponent*Ln(base));
END;
```

Figure 2: *A simpler function for roots or powers in non-BCD Turbo.*

```
PROCEDURE ResetRO(VAR fil : Text);
  {resets a Read-Only text file}
TYPE
  regpack = RECORD
              AX, BX, CX, DX, BP, SI, DI, DS, ES, Flags : Integer;
            END;
VAR
  regs : regpack;

BEGIN
  IF MemW[Seg(fil):Ofs(fil)] = $FFFF THEN {{$FFFF indicates closed file}
    WITH regs DO
      BEGIN
        AX := $3D00;            {Function 3D - Open File}
        DS := Seg(fil);         {AL=0 - Open for Read-Only}
        DX := Ofs(fil)+12;      {DS:DX point to file spec}
        MsDos(regs);
        IF (FLAGS AND 1) = 1 THEN {Must use Carry Flag to}
          BEGIN                 {determine if DOS error}
            CASE AX OF
              2 : WriteLn('File Not Found');
              3 : WriteLn('Path Not Found');
              4 : WriteLn('No Handle Available');
              5 : WriteLn('Access Denied');
            END;
            Rslt;
          END;
        MemW[Seg(fil):Ofs(fil)) := AX; {save file handle in FIB+0}
      END;
  Mem[Seg(fil):Ofs(fil)+2) := $80; {Flags byte - Read-Only}
  MemW[Seg(fil):Ofs(fil)+6] := $0080; {Buffer Length - 128 bytes}
  MemW[Seg(fil):Ofs(fil)+8) := MemW[Seg(fil):Ofs(fil)+4);  {Reset file}
  MemW[Seg(fil):Ofs(fil)+10) := MemW[Seg(fil):Ofs(fil)+4); {  pointers}
END;
```

Figure 3: *A procedure to open a read-only file.*

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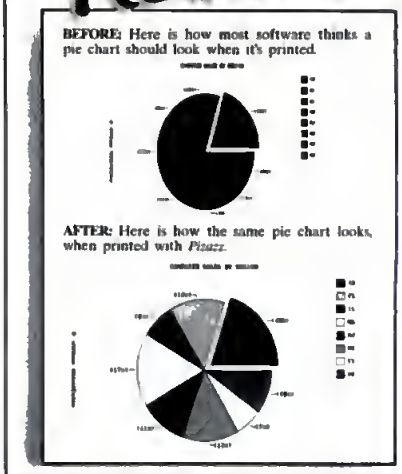

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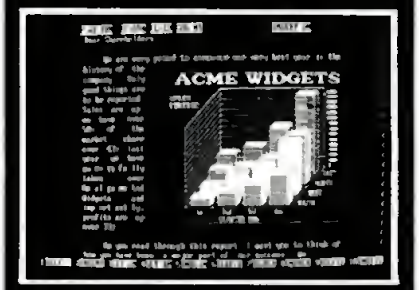

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rectly opens the file for input or returns the DOS error message if DOS cannot open the file as requested.

Roy Murphy
Wilmington, Delaware

Mr. Murphy's procedure will Reset only read-only text files. However, with some study of the Turbo manual's information on File Interface Blocks, you can create a similar procedure for random-access files. Of course, you'll get an error if you try to write to a file you've opened in this way.

FORCING A REBOOT

I needed to end some of my programs with a forced reboot, so I wrote a Turbo Pascal routine that uses interrupt $19 (hexadecimal). This can be useful in many situations and produces a clean restart.

Philippe C. Lapotre
San Francisco, California

Mr. Lapotre's program, shown in Figure 4, will work on a plain IBM PC or close compatible with no RAM-resident programs or device drivers. However, precisely because it does not reset the interrupt vector table or the BIOS data area, it will fail on some systems. The program in Figure 5 forces the reset in a more conventional way—it duplicates the code invoked when you press the key combination Ctrl-Alt-Del.

■ ResetRO mimics the operations that Reset performs and correctly opens a file for input.

LABELMAKER

The ability to put volume labels on disks was added with the release of DOS 2.0, but they could only be added during formatting. This created a problem, as often the eventual use of the disk was unknown when it was first formatted. *The Norton Utilities* and DOS 3.*x* allow you to relabel your disks, but not everyone can access these programs.

```
PROGRAM Reboot;
BEGIN
  INLINE($CD/$19);  {INT $19}
END.
```

Figure 4: *A reboot routine using interrupt $19.*

```
PROGRAM Reboot;
VAR reset_flag:Integer ABSOLUTE $0040:$0072;
BEGIN
  Write('Hit <Return> to re-boot'); Read;
  reset_flag := $1234;
  INLINE($EA/$5B/$E0/$00/$F0);{JMP F000:E05B}
END.
```

Figure 5: *An alternate reboot with system reset.*

```
{$R+}
PROGRAM volume;
TYPE
  {Extended File Control Block}
  xfcbtype = RECORD
               flag : Byte;
               reserved : ARRAY[1..5] OF Byte;
               attribute : Byte;
               drive : Byte;
               fname : ARRAY[1..11] OF Char;
               other : ARRAY[1..5] OF Byte;
               fname2 : ARRAY[1..11] OF Char;
               reet : ARRAY[1..9] OF Byte;
             END;
  regtype = RECORD                                    (continues)
```

Figure 6: *A Turbo program to read and change a disk's volume label.*

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■ TURBO POWER USER

The Turbo Pascal program shown in Figure 6 can be used to relabel any disk used with DOS 2.0 or later. The label can be a string up to 11 characters long, with spaces. Since you can't address label operations with the File Handle function calls under DOS 2.*x*, the program must instead use the extended File Control Block (FCB) to specify the volume functions.

The program starts by giving DOS a work area, known as the Disk Transfer Address (DTA), which is needed to hold the information found when searching the directory for an entry. If a volume label is found, the program displays it and prompts for a new label. It then issues a Rename File command to DOS, to replace the old label with the new. If it doesn't find an old label, it says so and requests the new label. It installs this label by creating a new directory entry with the volume attribute.

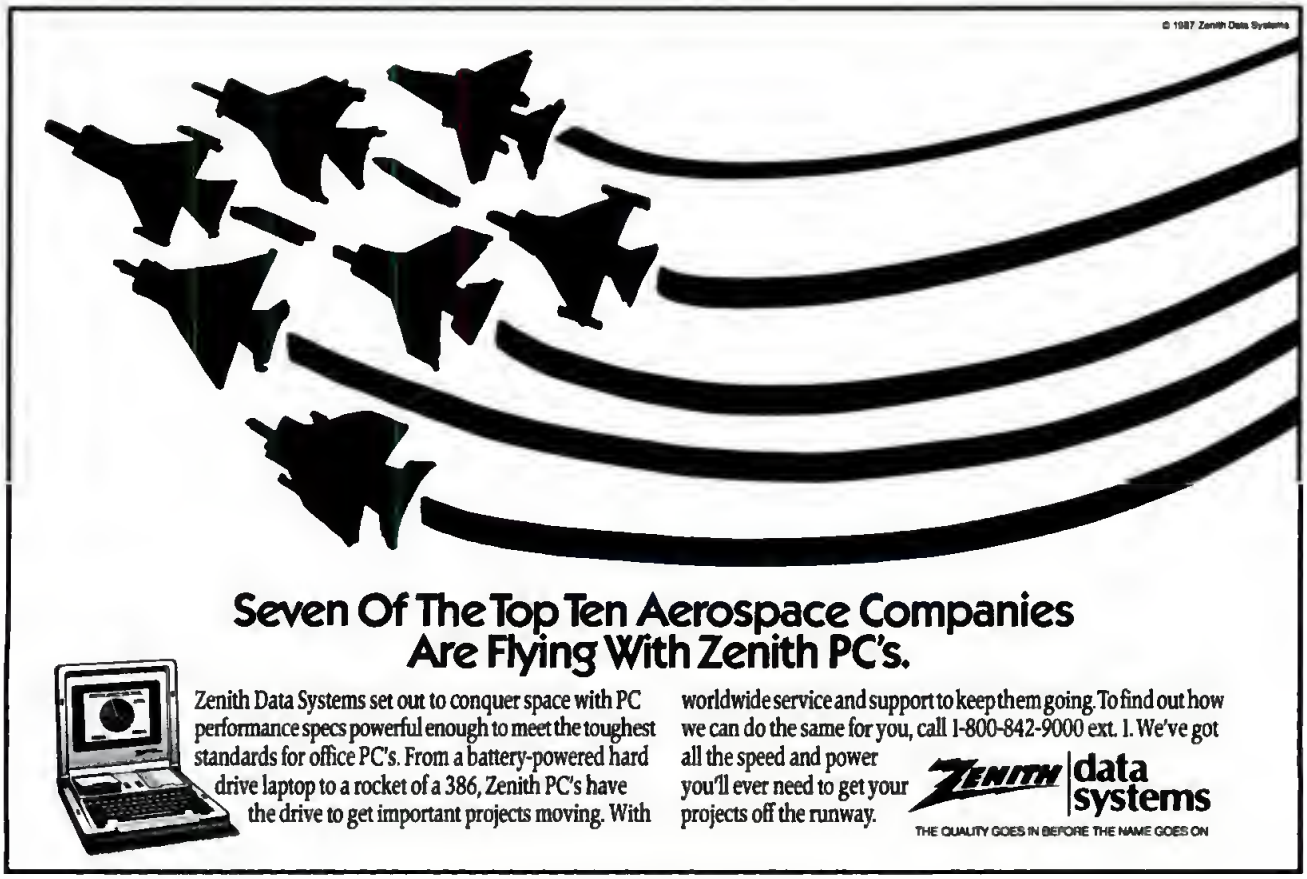
David W. Wormuth
Lowville, New York

```
                ex, bx, cx, dx, bp, si, di, da, es, flegs : Integer;
              END;
VAR
  i        : Byte;
  xfcb     : xfcbtype;
  regs     : regatype;
  dta      : ARRAY[1..64] OF Char;
  newlabel : ARRAY[1..11] OF Char;

  PROCEDURE xfcbinit;          { Initielize extended FCB }
  BEGIN
    WITH xfcb DO
      BEGIN
        fleg := $FF;
        FOR i := 1 TO 5 DO reserved[i] := 0;
        ettribute := $08;
        drive := 0;
        fname := '???????????';
        FOR i := 1 TO 5 DO other[i] := 0;
        FOR i := 1 TO 11 DO fname2[i] := Chr(0);
        FOR i := 1 TO 9 DO rest[i] := 0;
      END;
  END;

BEGIN
  regs.ax := $1A00;            { Set the DTA }
  regs.dx := Ofs(dta);
  rega.ds := Seg(dte);
  Intr($21, regs);
  xfcbinit;
  regs.ax := $1100;            { Seerch for volume lebel }
  rega.dx := Ofa(xfcb);
  rega.da := Seg(xfcb);
```

(Figure 6 continues)



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■ TURBO POWER USER

```
  Intr($21, rsgs);
  IF ((rags.ax AND $00FF) = 0) THEN {  Found voluma labal  }
    BEGIN
      Write('Currant volume lsbel "');
      FOR i := $08 TO $12 DO Writs(dts[i+1]);
      WritaLn('"');
      Write('    Entar new label:  ');
      RsadLn(newlabel);
      FOR i := 1 TO 11 DO afcb.fnams2[i] := newlabel[i];
      rsgs.aa := $1700;        {  Rsname voluma label  }
      rsgs.da := Ofs(afcb);
      rags.ds := Seg(xfcb);
      Intr($21, rags);
      IF ((regs.sa AND $00FF) = 0) THEN WritsLn('New volums lsbel inatallad.')
      ELSE WriteLn('Error in voluma lsbel.');
    END
  ELSE IF ((rsgs.sx AND $00FF) = $FF) THEN { No old voluma lsbal  }
    BEGIN
      WritsLn('Currsnt volums has no lsbal.');
      Write('Entsr new label: ');
      RsadLn(nswlabel);
      afcbinit;
      FOR i := 1 TO 11 DO xfcb.fnama[i] := nswlsbsl[i];
      rsgs.sx := $1600;        {  Crsats new voluma lsbel  }
      raga.dx := Ofs(xfcb);
      rsgs.ds := Seg(afcb);
      Intr($21, regs);
      IF ((regs.sx AND $00FF) = 0) THEN
        WritaLn('New volums lsbel inatsllsd.')
      ELSE WriteLn('Error. Root dirsctory is probably full.');
      WritaLn('AL = ', (regs.aa AND $00FF));
    END
  ELSE WritaLn('Unknown disk srror.');
END.
```

(Figure 6 ends)

Who would have thought that we'd have to go back to the antediluvian concept of File Control Blocks after the File Handle functions were introduced into DOS! But, as Mr. Wormuth indicates, there's no other way to change the volume label except by going to the trouble of directly modifying disk sectors.

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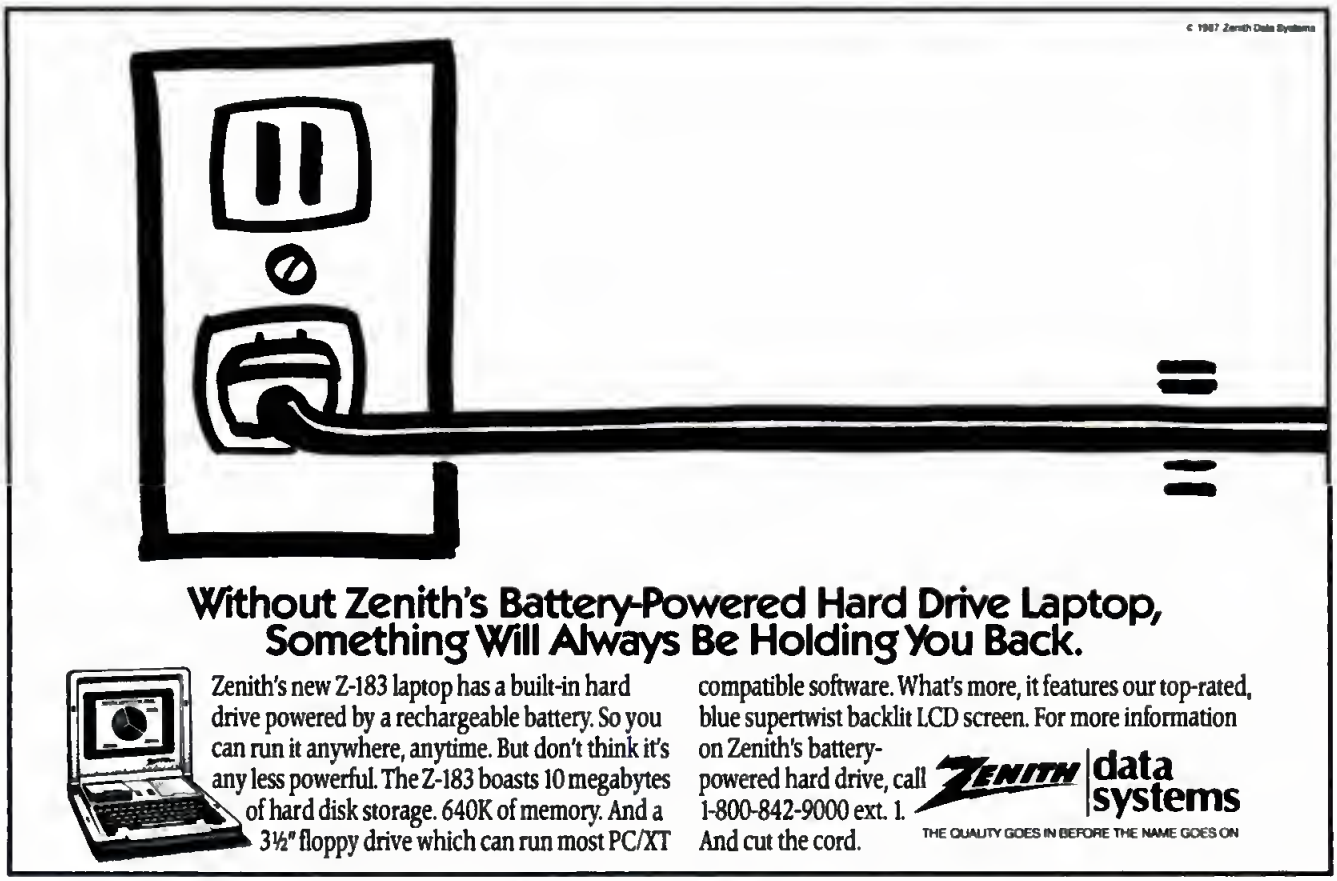
Neil J. Rubenking is a professional Pascal programmer.



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The MONCHECK.BAS compiled BASIC program in Figure 1 checks for the presence of a Compaq graphics adapter, an Enhanced Graphics Adapter, a Color/Graphics Adapter, a Hercules monochrome/graphics adapter, or a monochrome adapter (every possible video adapter installed on our Novell SFT Advanced/286 network).

Alex E. Perez
Miami, Florida

Mr. Perez's submission contained a complicated method for selecting drivers, at the heart of which was a cascade of statements:

```
520 MON$="HND":GOTO 570
530 MON$="CPQ":GOTO 570
540 MON$="CLR":GOTO 570
550 MON$="EGA":GOTO 570
560 MON$="HRC"
570 SHELL "MAP "+COMMAND$+MON$+" > NUL:"
580 END
```

Each test jumped to the appropriate line in the cascade (e.g., if the program found an EGA, it jumped to line 550). Then the program used the DOS SHELL command to pass the appropriate driver code to the NetWare *MAP command. It uses the QB2 COMMAND$ function, so don't try it in interpretive BASIC.*

The program also assumes that certain copyright messages will be at certain absolute addresses. This is not the case with nonstandard video boards, and even mainstream manufacturers have been known to move or change their copyright message locations and content, to the consternation of users.

Would it really have been that hard for IBM to have roped off one memory location for monitor type? No. Did they? What do you think?

SEVERELY WARPED

Recently I left a box of diskettes in my car and had them ruined by the heat. The jackets were severely warped, and the diskettes could not be read.

Because of the importance of the information they carried, I tried an experiment. I slit the bottom of one unusable diskette

```
100 'MONCHECK.BAS -- identifies monitor -- by Alex Perez
110 CLS:LOCATE 1,1,0
120 '
130 ' Check if Compaq by reading "COMPAQ" at FFFE:000A
140 ' Then check if this CPU has an EGA adaptar
150 '
160 DTSG=&HFFFE:DTA$="COMPAQ":DLC=&HA:GOSUB 430
170 IF DTA$=DTARD$ THEN CPU$="COMPAQ"
180 '
190 ' Check for EGA by reading "IBM" at C000:001E
200 ' If no EGA then check the value of CPU$
210 ' IF value = "COMPAQ" then COMPAQ, otherwise keep checking
220 '
230 DTSG=&HC000:DTA$="IBM":DLC=&H1E:GOSUB 430
240 IF DTA$=DTARD$ THEN MON$="n EGA":GOTO 390
250 IF CPU$="COMPAQ" THEN MON$="COMPAQ":GOTO 390
260 '
270 ' Check if mono or color by reading motherboard switches
280 ' If mono then check for hercules or plain monochrome
290 '
300 DEF SEG=0:IF (PEEK(&H410)AND &H30)<>&H30 THEN MON$=" CGA":GOTO 390
310 '
320 ' Read and isolate the 7th bit of I/O port &H3BA
330 ' If it changes then Hercules; if not assume plain mono
340 '
350 A=(INP(&H3BA)AND &H80):T=TIMER
360 IF T+1 =< TIMER THEN MON$=" Mono":GOTO 390 ELSE B=(INP(&H3BA)AND &H80)
370 IF B<>A THEN MON$=" Hercules":GOTO 390 ELSE 360
380 '
390 PRINT "You have a";MON$:END
400 '
410 '            SUBROUTINE FOR READING DATA FROM SYSTEM ROM
420 '
430 DTARD$="":DEF SEG=DTSG:FOR I=1 TO LEN(DTA$)
440 RD=PEEK((DLC-I)+I):DTARD$=DTARD$+CHR$(RD)
450 NEXT I:DEF SEG:RETURN
```

Figure 1: *Program that detects the type of monitor being used.*

Minimize Turbo Pascal compile time.

Dramatically reduce debugging time.

Tmark allows Turbo Pascal to continue compiling without returning to line 1.

Tmark is a utility that fixes an annoying limitation of Turbo Pascal. Normally, every time Turbo finds an error while compiling, it must start compiling again from the very beginning. Tmark changes that. It allows Turbo to resume compiling from where you fixed the error, not back at line 1.

Tmark runs Turbo Pascal as a child process. This allows Tmark to monitor Turbo as it compiles your program. When Tmark detects that Turbo is about to issue an error message, it saves, on disk, an image of the memory and registers used by Turbo Pascal up to that point. Once you have fixed the error, Tmark will restore Turbo to its state before the error was found. Turbo will then resume compiling—from the fix.

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CIRCLE 217 ON READER SERVICE CARD

■ USER-TO-USER

■ This data recovery solution is useful when the post office ships a disk under a box of uranium ingots.

with a razor blade and very carefully removed the magnetic media. After repeating this process with a new diskette, I inserted the media from the damaged disk into the new jacket. I put it in the disk drive and it worked. I then copied the contents of the damaged disk to a new one.

I realize that if I had been more careful, this would not have been necessary, but using this technique I was able to salvage all but one file on the 10 damaged diskettes. If anyone else is ever careless with his diskettes, this technique might prevent a crisis.

John C. Peace
Spring Valley, California

This solution has been around for years and is also useful when someone sends a disk through the mail and the post office decides to ship it across the country at the bottom of a truckload of uranium ingots. In fact, when disks go bad, we save the jackets and recycle them in cases like this.

Editor Bill Machrone has a magic touch when it comes to frozen diskettes, and has his own technique—he grasps the disk by the corners and saws the sharp edges of the disk against the edge of a desk.

KICKING THE PIPE HABIT

Pipes should be avoided when they are not needed because MS-DOS, being single-tasking, must create an intermediate disk file to pass the data between programs. A pipe can add substantially to the execution time of a batch file.

For example, the SCANBATS.BAT file scanners (Volume 6 Number 6) could run twice as fast by replacing the line

```
TYPE %1 | MORE
```

with

```
MORE < %1
```

in READ.BAT. You can verify this by running the old set of batch files (SCAN-

```
rem scanbat1.bat
echo off
for %%f in (*.bat) do command /c read1 %%f

rem read1.bat
echo off
cls
echo %1
type %1 | more
pause
```

Figure 2: *Original slow batch-scanning files that use pipes.*

```
rem scanbat2.bat
echo off
for %%f in (*.bat) do command /c read2 %%f

rem read2.bat
echo off
cls
echo %1
more <%1
pause
```

Figure 3: *Improved fast batch-scanning files that avoid pipes.*

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We couldn't agree more with John Dvorak, and couldn't have said it better: "Buy the Brooklyn Bridge from White Crane Systems.... It's a combination cable and software package that hooks the Toshiba or Zenith (and other MS-DOS laptops) to your PC, XT or AT via the serial port and allows you full access to all the disk drives of both machines for effortless file transfer (at 115K bits per second).... Installation is a snap. It works first time out, no glitches. It's transparent. It's great. And since it's priced at $129.95, it would be silly to buy an add-on drive for your MS-DOS laptop.

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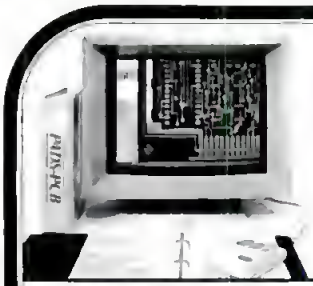

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CIRCLE 740 ON READER SERVICE CARD

■ USER-TO-USER

BAT1.BAT and READ1.BAT) in Figure 2, and then the new (SCANBAT2.BAT and READ2.BAT) in Figure 3. Once you've created them, type SCANBAT1 and SCANBAT2.

Carl Bergerson
Irvine, California

This not only speeds things up, but does away with those odd piping artifacts in the directory with names like 1608091F and 16080924.

FLEXIBLE ERRORLEVEL

Many DOS 2.0 or later users are familiar with the ability to branch in a batch file based on an IF ERRORLEVEL test. The KEYPRESS.COM program, created by the KEYPRESS.BAS file in Figure 4, makes such tests flexible and easy. The format is

KEYPRESS [*list of valid characters*]

where [*list of valid characters*] is a list of one or more displayable characters (optionally separated by one or more spaces), for example,

KEYPRESS a b c d

KEYPRESS waits for the user to press a key, then compares that key with the list of valid characters. If it's in the list, KEYPRESS returns a DOS exit code set to the index of the character pressed in the list of valid characters; if it's not, KEYPRESS

```
100 ' Program for creating KEYPRESS.COM -- Louis J. Cutrona, Jr.
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 6:FOR C=1 TO 16:READ A$:TTL=TTL+VAL("&H"+A$):NEXT
130 READ S:IF S=TTL THEN 150
140 PRINT "DATA ERROR IN LINE";B*10+190;" -- REDO":END
150 TTL=0:NEXT:RESTORE
160 OPEN "KEYPRESS.COM" AS #1 LEN=1:FIELD #1,1 AS D$
170 FOR B=1 TO 6:FOR C=1 TO 16:READ A$
180 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
190 CLOSE:PRINT "KEYPRESS.COM CREATED"
200 DATA B4,07,CD,21,3C,00,75,0A,B4,07,CD,21,30,C0,B4,4C,1533
210 DATA CD,21,3C,41,72,06,3C,5A,77,02,04,20,88,C4,B6,20,1336
220 DATA 30,D2,30,ED,8A,0E,80,00,E3,22,BE,81,00,AC,38,F0,1871
230 DATA 75,86,E2,F9,30,D2,EB,14,3C,41,72,06,3C,5A,77,02,1627
240 DATA 04,20,FE,C2,38,E0,74,04,E2,E3,30,D2,88,D0,B4,4C,2195
250 DATA CD,21,00,08,00,00,00,00,00,00,08,00,00,08,00,00,238
```

Figure 4: *KEYPRESS.BAS program to create KEYPRESS.COM batch file branching utility.*

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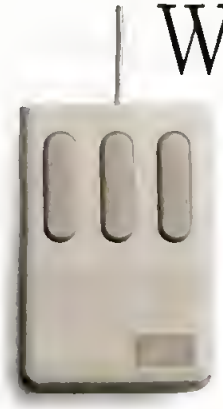

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returns an exit code of 0. So if the batch file included the line in the example and the user typed in a C, KEYPRESS would report a 3, since c is the third character in the list. To allow greater flexibility, KEYPRESS does not distinguish between upper- and lowercase letters.

A sample batch file might look like this:

```
echo off
:query
echo      Available Programs:
echo           a.      123
echo           b.      dBase
echo Your choice (a/b) ?
KEYPRESS a b
if errorlevel 2 goto b
if errorlevel 1 goto a
echo Invalid reply, try again.
goto query
:a
123
goto exit
:b
dbase
:exit
```

Note that the exit codes returned by KEYPRESS must be checked from highest to lowest (right to left in the list of valid characters) because IF ERRORLEVEL *n* succeeds if the exit code is greater than or equal to *n*.

Louis J. Cutrona, Jr.
Ridgewood, New Jersey

■ KEYPRESS lets users specify different menus of responses such as y n, 1234, 1 W D (for a menu of 1-2-3, Wordstar, and dBASE), or even !@#$.

This variation on the GETYES.COM type of ERRORLEVEL code-setter that we've published previously is noteworthy because it lets users specify different menus of responses such as y n, 1234, 1 W D (for a menu of 1-2-3, WordStar, *and* dBASE*), or even !@#$. And KEYPRESS is case insensitive, which eliminates tedious double testing.*

BETTER AUTOMATION

Using small files (like one containing just a Y and a carriage return) along with redirection of input to automate certain processes is a good idea. However, you can do even better using pipes, since even a 2-byte file takes up a minimum disk allocation of from 512 to 8K bytes.

If you wanted to delete all files on a disk with a single command, rather than using

```
ERASE *.* < Y.TXT
```

(where Y.TXT is a small file containing

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■ USER-TO-USER

just Y and a carriage return), use

```
ECHO Y | ERASE * *
```

However, there's a problem—the DOS 3.*x* ECHO command won't send just a single carriage return. This problem is solvable because the MORE command places a carriage return at the very beginning of its output. So to run the TIME command and send it a carriage return so that it exits, just use

```
ECHO read this one | MORE | TIME
```

Since TIME exits after the first carriage return, the message in echo gets sent to the bit bucket.

Barry Simon
Pasadena, California

■ Using small files along with redirection of input to automate certain processes is a good idea. However, you can do even better using pipes.

Thanks to the several dozen readers who sent in letters reminding us that it was indeed more efficient to pipe a Y into a command needing a Y or N response. The MORE trick makes it even better, but it's obviously for hard disk users who already have MORE.COM on their disk. But be careful when piping a Y—the "Are you sure (Y/N)?" confirmation is there for a reason.

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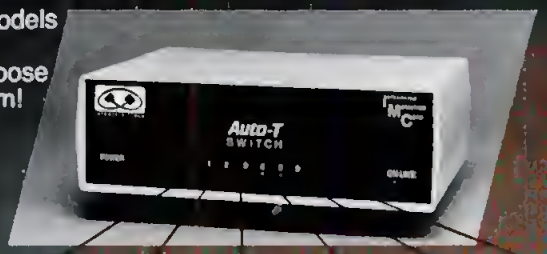

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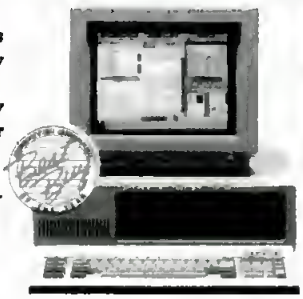

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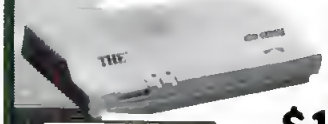

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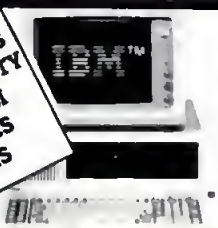

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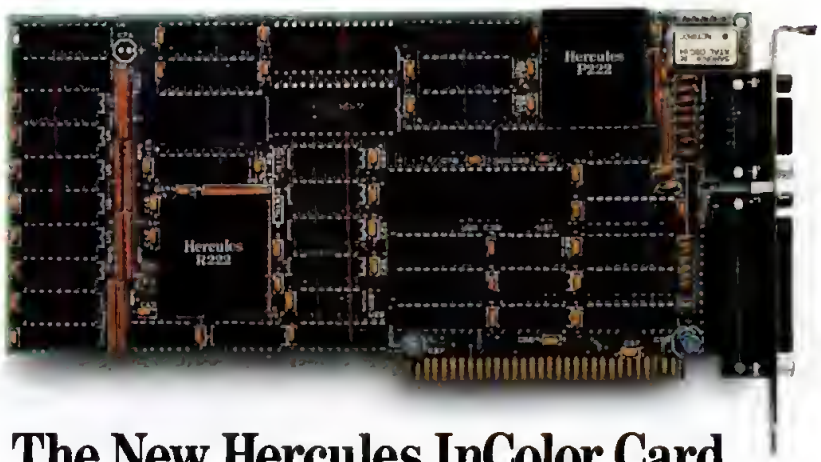

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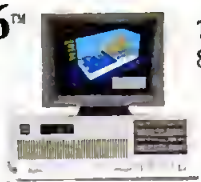

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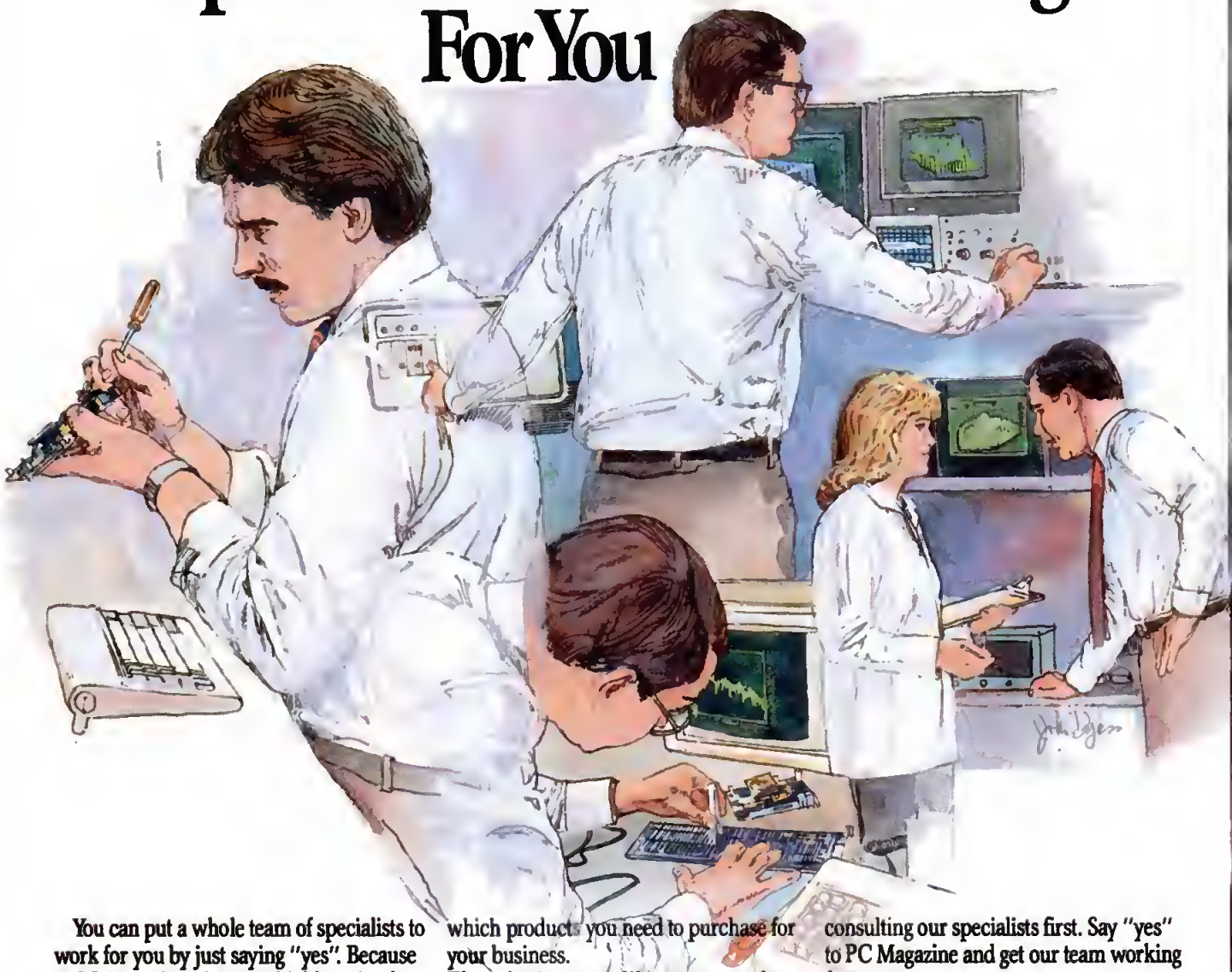

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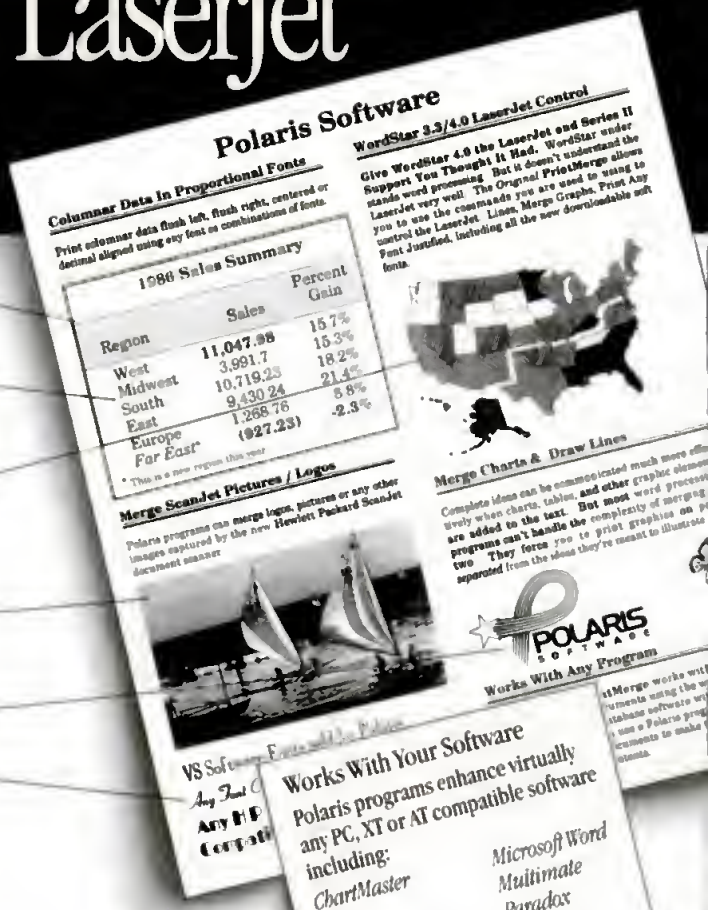

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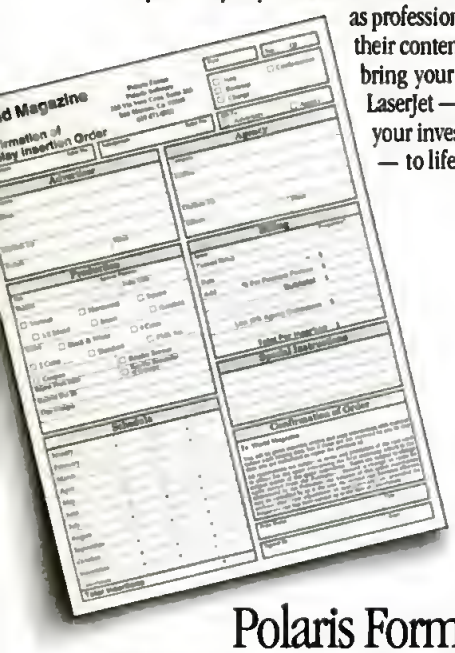

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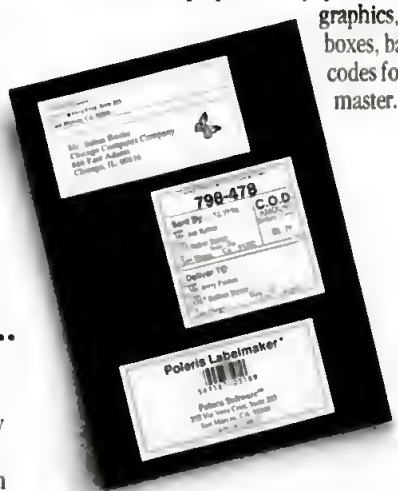

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■ CHARLES PETZOLD

PC TUTOR

Handling extended keycodes in ANSI.SYS; pouring new DOS into old 1-2-3 System Disks; why you can't format two disks simultaneously; fixing PRNSWAP.COM.

ENHANCED KEYBOARD CODES

Following the examples in a previous PC Tutor (Volume 6 Number 3), I have redefined several function keys on my keyboard using ANSI.SYS. When I tried to find the scan codes for the F11 and F12 keys on the AT's enhanced keyboard, however, I couldn't get them. My dealer queried IBM and found out the codes were 122 and 123, but these still don't work.

Is there a way to redefine F11 and F12?

Jim Kinney
Western Springs, Illinois

You were misinformed—the codes for the F11 and F12 keys are actually 133 and 134. However, don't rush off and try them just yet. There's a catch.

When IBM designed the BIOS support for the enhanced keyboard, they added over 30 new extended keyboard codes, starting at 133. However, they did not make these keyboard codes available to programs through the normal BIOS keyboard interface. To do so would have created incompatibilities with some existing programs. For instance, some keyboard macro programs define their own extended keys and these may conflict with the new IBM codes.

DOS (and most programs) get keyboard information from the BIOS through interrupt 16h, function calls 0, 1, and 2. For the enhanced keyboard, IBM defined new function calls numbered 10h, 11h, and 12h that duplicated 0, 1, and 2, except that the new calls also return the new extended keyboard codes in addition to the old ones.

Figure 1 shows a DEBUG script for a NEWKEYS.COM program you can create that allows DOS access to the new codes and thus allows you to use these new keys with ANSI.SYS. You can create NEWKEYS.COM by typing the lines shown into a file called NEWKEYS.SCR. (You don't need to type the semicolons or the comments that follow them.) Then execute

```
DEBUG <NEWKEYS.SCR
```

This creates NEWKEYS.COM.

NEWKEYS.COM is a terminate-and-stay-resident program, so it need be loaded only once during your PC session. Like most TSRs, it may have some compatibility problems with other programs. If everything seems to work OK once you load it, then you're probably in good shape.

When NEWKEYS is loaded, you can use the extra keyboard codes for ANSI.SYS redefinitions. The new codes are shown in Figure 2. (The old codes can be obtained from the IBM BASIC manual.) For in-

```
N NEWKEYS.COM
A
JMP     013A            ; Jmp Initialize
DW      0,0
CMP     AH,00           ; NewInt16:
JZ      0115            ; Jmp GetKey
CMP     AH,01
JZ      0121            ; Jmp GetStatus
CS:
JMP     FAR [0102]      ; Jmp OldInt16
MOV     AH,10           ; GetKey:
PUSHF
CS:
CALL    FAR [0102]      ; Call OldInt16
CALL    0131            ; Call FixUp
IRET
MOV     AH,11           ; GetStatus:
PUSHF
CS:
CALL    FAR [0102]      ; Call OldInt16
JZ      012E
```

(continues)

Figure 1: *This DEBUG script file creates a remain-resident program called NEWKEYS.COM that lets DOS use the new keyboard codes defined for the IBM enhanced keyboard.*

Boost cursor speed.

Stop cursor run-on.

With all the recent hoopla over performance, it's ironic that two of the PC's ergonomic deficiencies have been overlooked — its slow cursor, and the tendency of the cursor to remain in motion (run-on) after a cursor key has been released. Finally, the solution — Cruise Control™ from Revolution Software.

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■ PC TUTOR

stance, the ANSI sequence for redefining the F11 key to do a DIR command is

```
<Esc>[0;133;"DIR";13p
```

UPGRADING A 1-2-3 SYSTEM DISK

My Release 1A *1-2-3* diskette has the DOS 2.0 IBMBIO.COM, IBMDOS.COM, and COMMAND.COM files on it.

How do I change these three files to the DOS 3.1 versions?

Rogerio Colonna
Rio de Janeiro, Brazil

Maybe it's time for another Bronx cheer for copy protection. (All together now.)

```
CALL    0131            ; Call FixUp
RETF    0002
CMP     AL,E0           ; FixUp:
JNZ     0139
SUB     AL,AL
CMP     AL,01
RET
MOV     AX,3516         ; Initialize:
INT     21              ; Get OldInt16
MOV     [0102],BX       ; Save it
MOV     [0104],ES
MOV     DX,0106
MOV     AX,2516
INT     21              ; Set NewInt16
MOV     DX,013A
INT     27              ; Stay Resident

R CX
54
W
Q
```

(Figure 1 ends)

Extended Code	Key	Extended Code	Key
133	F11	149	Ctrl /
134	F12	150	Ctrl *
135	Shift F11	151	Alt Home
136	Shift F12	152	Alt Up-Arrow
137	Ctrl F11	153	Alt Page-Up
138	Ctrl F12	155	Alt Left-Arrow
139	Alt F11	157	Alt Right-Arrow
140	Alt F12	159	Alt End
141	Ctrl Up-Arrow	160	Alt Down-Arrow
142	Ctrl -	161	Alt Page-Down
143	Ctrl 5	162	Alt Insert
144	Ctrl +	163	Alt Delete
145	Ctrl Down-Arrow	164	Alt /
146	Ctrl Insert	165	Alt Tab
147	Ctrl Delete	166	Alt Enter
148	Ctrl Tab		

Figure 2: *IBM's new extended keyboard codes for the enhanced keyboard.*

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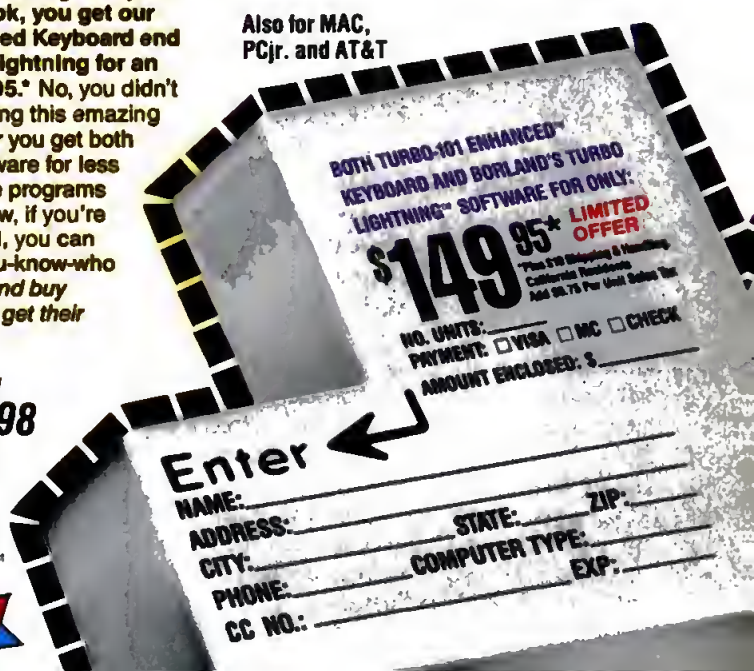

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■ PC TUTOR

Now that we feel better, let's solve the problem.

The normal way to upgrade a bootable disk to a new DOS version is to use the SYS command. The SYS command transfers the IBMBIO.COM and IBMDOS.COM files to the old disk. The regular COPY command is then used to copy the new version's COMMAND.COM to the old system disk. (The IBMBIO and IBMDOS files will not be visible when you do a normal DIR command because they are hidden files, but you can see them if you do a CHKDSK with a /V parameter.)

The tiny 512-byte boot record on the disk has an important job. It must read IBMBIO and IBMDOS from the disk and load them into memory. It's handicapped greatly because IBMBIO and IBMDOS know all about using files and the disk, but the boot record can't use them because the files aren't in memory yet. The reason we call this process a "boot" is because DOS is essentially pulling itself up by its bootstraps.

Because of this handicap, the boot record requires that IBMBIO.COM and IBMDOS.COM be the first two directory entries, and that IBMBIO.COM be at the beginning of the disk data area in contiguous sectors. (The IBMDOS.COM can be anywhere on the disk.)

So here's the problem: DOS has grown so much that diskettes prepared for earlier DOS versions do not have enough room for the newer IBMBIO.COM files. Specifically, the 1-2-3 (1A) disk from Lotus has 1920 bytes allocated for IBMBIO.COM and 6400 bytes for IBMDOS.COM. The PC-DOS 3.1 IBMBIO file is 9564 bytes. For PC-DOS 3.2, it's up to 16,368 bytes.

What you have to do is temporarily get rid of the file that prevents IBMBIO.COM from being stored in contiguous sectors. In the case of the Release 1A 1-2-3 system disk, this file is the first one you see when you do a DIR command: 123.EXE. First, use the COPY command to copy 123.EXE to another diskette. Next (assuming you have the DOS disk in drive A: and the 1-2-3 System Disk in drive B:, and drive A: is the default), execute the following commands:

```
DEL B:123.EXE
SYS B:
COPY COMMAND.COM B:
```

Now copy the 123.EXE file back to the System Disk. (You could even copy it from the backup copy of the System Disk if you wanted.)

The copy protection used in 1-2-3 (1A) is pretty innocuous, so you can safely copy files to other diskettes and then copy them back. Other copy-protected software may require that all the files be in certain sec-

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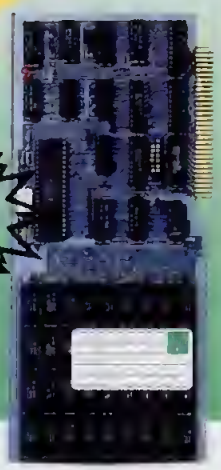

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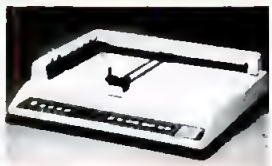

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■ PC TUTOR

tors. This technique will not work with those disks. If you want to experiment, you should first get one of those programs that successfully copy copy-protected disks (Copy II PC is the best known) so you can make your modifications on a copy instead of an original.

DUAL FORMATS

I've been trying—not very successfully—to write a program that would run two versions of FORMAT. There are situations where I have to format about a hundred diskettes in a row, and what I'd really like to do is format diskettes in both the A: and B: drives simultaneously. Such a utility would certainly save me lots of time. Is it possible?

Edward Pattillo
Westminster, California

It might be possible to format two diskettes at once, but it would take twice as long. You're encountering a hardware restriction: both diskettes are attached to the same diskette controller, and the diskette controller can control only one diskette at a time.

CORRECTION

A printing error cut short several lines of the program for toggling between LPT1 and LPT2 in "Swapping Printers," Volume 6 Number 9. The correct entries in DEBUG should be:

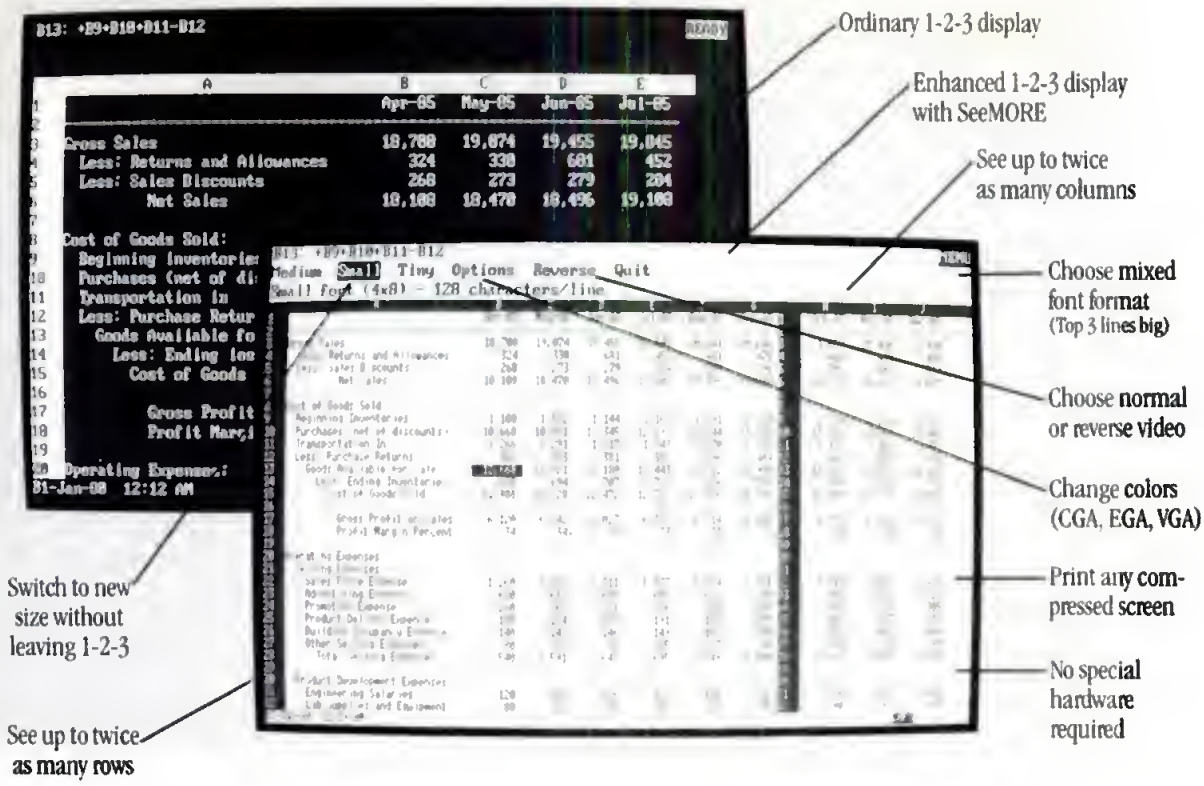
```
N PRNSWAP.COM
A
POP DS
MOV AX,[408]
XCHG AX,[40A]
MOV [408],AX
INT 20

R CX
D
W
Q
```

Include the blank line indicated.

ASK THE TUTOR

The PC Tutor solves practical problems and explains points of general interest. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016.



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*Starch Study, July 1986

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The 410 color plotter will connect to the **serial port** of virtually any microcomputer Simple ASCII commands direct one of the four color pens to draw circles arcs or ellipses on paper or transparency material up to 11 by 17 inches. Enlargements or reductions are achieved through elaborate firmware Pen travel is four inches per second with .004" pen resolution. Standard pens are available in an assortment of 32 different colors and widths
The ideal plotter for architecture, CAD engineering or graphic design **At $595 it was a great buy, at $159 its a steal.** Support kits for specific computers

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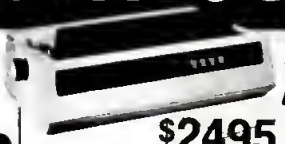

Free Interface Kit

$2495 80 Character Daisy Wheel Printer $759

These Fujitsu Daisy Max 630 were manufactured for Motorola's Computer Division The purchase order was canceled and Fujitsu was forced to liquidate these 80 character per second daisy wheel printers at "fire sale" prices!
Features bullet proof construction, serial RS-232 interface Diablo 630 wheels and commands programmable line spacing in increments of 1/96 and column spacing of 1/120 The printer is also capable of underscoring bold overprint, shadow print, centers and justifies along with vector plotting
Factory suggested price of the Daisy Max 630 was $2495, California Digital is offering this liquidated special at only $759 and including FREE a serial card kit with cable Also available tractor and sheet feeders

COLOR GRAPHICS TERMINAL $3995 $659

The Lear Siegler 7107 color graphics terminal is both DEC (VT-100 / VT-51) and Tektronix (4010/4014) compatible
The terminal offers a palette of 4,096 colors with a resolution of 640 by 480 pixels on a 13 inch non-glare black screen
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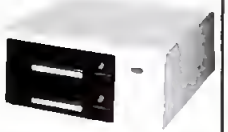
The 7107 is the ideal terminal for CAD/CAM applications.

20/20 Bernoulli Box

~~$3495~~

$1595



California Digital has purchased these 20/20 Bernoulli systems from Iomega
The units needed some minor alignment and had to be sent back to Iomega. These have to sold as as reconditioned but for all practical purpose they are new and come with a **one year Iomega factory warranty.**
The 20/20 Bernoulli Box features removable cartridges, and delivers reliability, expandability, transportability, security and speed in one versatile subsystem It lets you transfer megabytes of information safely and swiftly for primary or backup storage Or combine several software programs onto a single cartridge for easy switching from one to another
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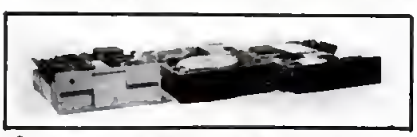

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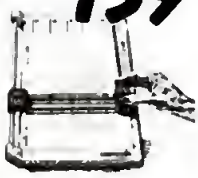

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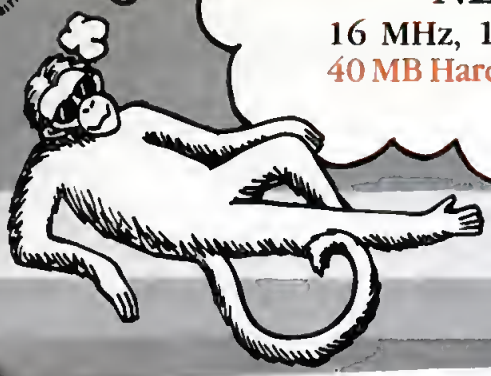

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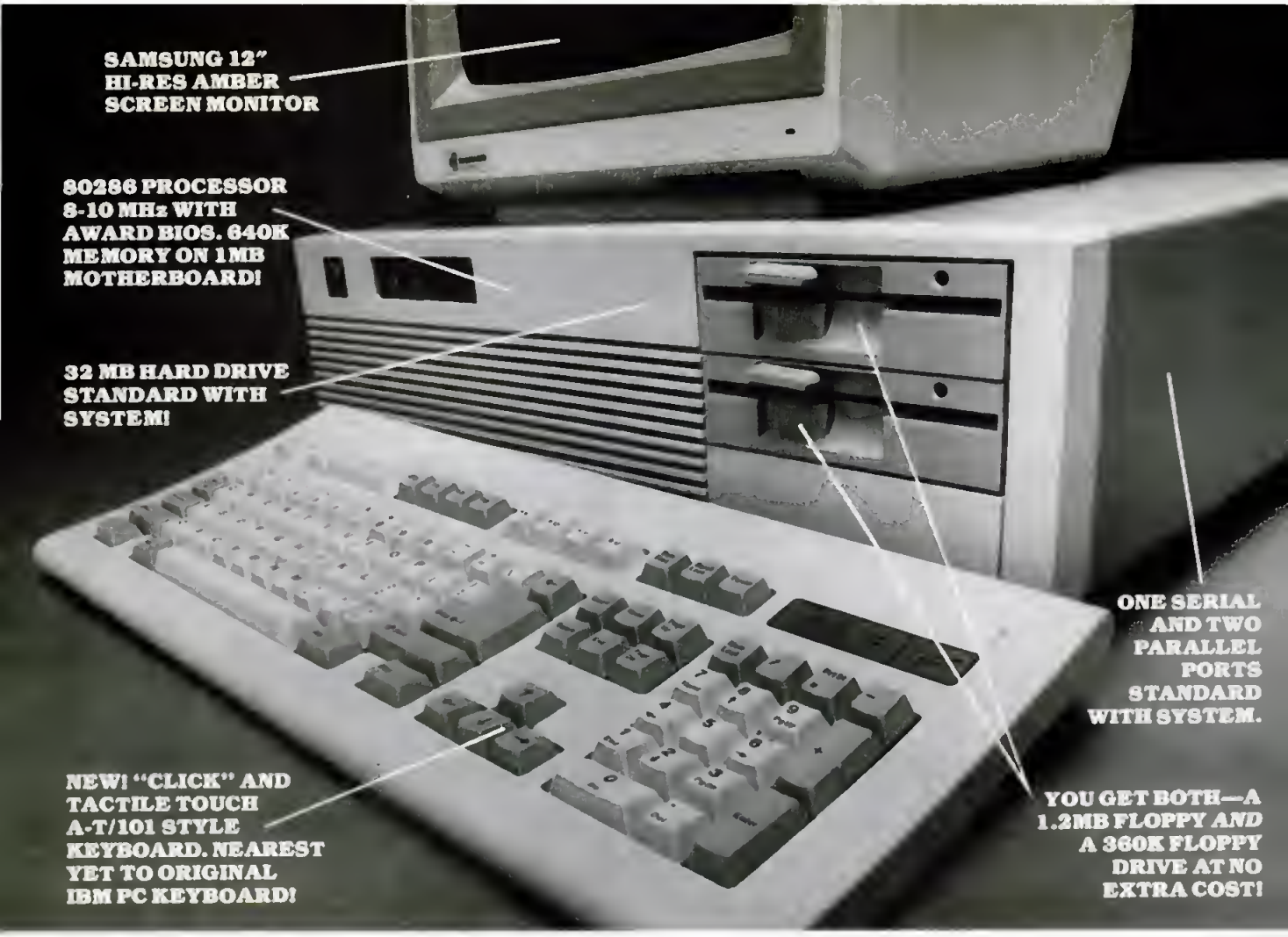

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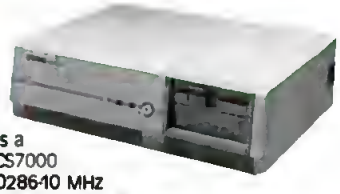

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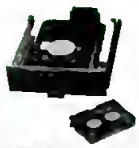

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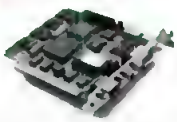

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- Line-busy detect and auto redial
- MIRROR II software, a $69 Value!
- Made in USA quality
- 1-year warranty

Scribe 32 hard disk card

$459

- Miniscribe Model 5CXT30
- 32.7 MB High Speed RLL 2,7 Drive
- 68 msec Average Access Time
- Western Digital Controller
- 1DIR software
- Low power—14 watts
- Installation instructions
- 1-year warranty

ScribeCardAT 32MB $555

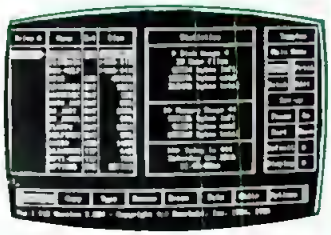
30 MB Seagate hard disk kit

$388

- Seagate ST238R 31.5 MB Drive
- Western Digital RLL controller
- 65 msec average access
- 25-page user manual
- Cables, mounting screws
- 1-year warranty
- 1dir software
- Optional 150-watt power supply $69

20MB with Seagate Controller $333
40MB 40 ms, ST251 kit $599

free 1dir with all hard disks.



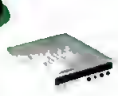
AT hard disk drives

- Includes mounting rails, & data cable
- 1DIR Hard Disk Organizer Software
- Drives over 33MB include large drive software.

Size	Model	Speed	Capacity	Price
FH	Seagate ST403B	40ms	31.9MB	$577
HH	Seagate ST251	40ms	42.8MB	$529
FH	Seagate ST4051	40ms	42.5MB	$666
FH	Seagate ST4096	28ms	80.2MB	$919
FH	Micropolis 1325	28ms	71MB	$944
FH	Priam 519	20ms	133MB	$2295
FH	Maxtor 1140	27ms	117MB	$2450
FH	Priam 519/Award	20ms	159MB	$2395

2400 external modem

$279



- Private Label version of Micom M3124H
- 300/1200/2400
- MNP level 4 error correction
- Automatic Adaptive Equalization
- 100% Hayes compatibility
- Non-volatile memory retains configuration
- FREE MIRROR II SOFTWARE $69 Value

2400 INTERNAL MNP MODEM $239

Streaming tape backup

$649

- Dedicated full-length controller
- Fast, backup at 5 MB/min
- DC600 cartridge holds 60 MB
- Menu-Driven software with context sensitive help
- 1-year warranty
- Internal $649, External $699

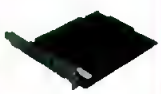
3½" 720K floppy kit

$129

- For internal mounting PC/XT/AT
- AT rails, grey & black bezel
- Mounting hardware & manual
- Requires DOS 3.2
- 90-day warranty

768K ems

$149



- 768K of 120 nanosecond RAM
- Lotus-Intel-Microsoft compatible
- Short slot card
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- 1-year warranty

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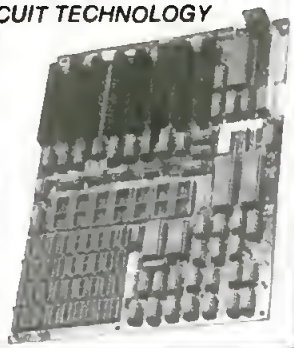

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BOTH WITH FREE MCT BIOS!

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JDR PART #: FAR-FDD

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- INCLUDES CABLE FOR 2 DISK DRIVES

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IBM COMPATIBLE FLOPPY DISK DRIVE

JDR PART #: FDD-360

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- DS/DD
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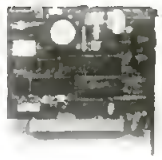

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1200 BAUD HALF CARD

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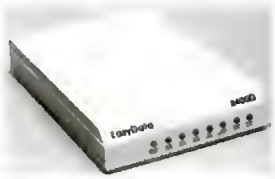

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- FULL 256K OF VIDEO RAM ALLOWS 640 x 350 PIXELS IN 15 OF 64 COLORS
- LIGHT PEN INTERFACE

MCT-CG $49.95

COMPATIBLE WITH IBM COLOR GRAPHICS STANDARD

- SHORT SLOT CARD USES VLSI CHIPS TO INSURE RELIABILITY
- SUPPORTS RGB, COMPOSITE MONOCHROME & COLOR AND AN RF MODULATOR OUTPUT
- 320 x 200 COLOR GRAPHICS MODE
- 640 x 200 MONOGRAPHICS MODE
- LIGHT PEN INTERFACE

MCT-MGP $59.95

COMPATIBLE WITH IBM MONOCHROME AND HERCULES GRAPHICS STANDARDS

- SHORT SLOT CARD USES VLSI CHIPS TO INSURE RELIABILITY
- PARALLEL PRINTER PORT, CONFIGURABLE AS LPT1 OR LPT2
- 720 x 348 GRAPHICS MODE
- LOTUS COMPATIBLE
- CAN RUN WITH COLOR GRAPHICS CARD IN THE SAME SYSTEM

MCT-MG $79.95

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- SERIAL PORT OPTION
- PARALLEL PRINTER PORT
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- 80 x 25 TEXT MODE
- LOTUS COMPATIBLE
- SELECTABLE TO RUN ALONG WITH COLOR GRAPHICS CARD IN THE SAME SYSTEM

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PLEASE NOTE THIS CARD WILL NOT RUN LOTUS GRAPHICS AND DOES NOT INCLUDE A PARALLEL PORT

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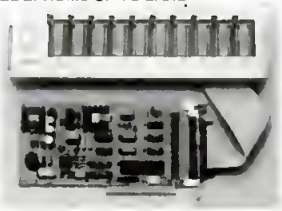

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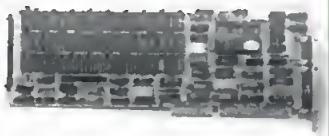
- SOFTWARE FOR A RAMDISK, PRINT SPOOLER AND CLOCK/CALENDAR

MCT-ATMF $139.95

ADDS UP TC 3 MB OF 1 BIT RAM TO THE AT

- USSR SKPANDABLE TO 1.5 MB OF ON-BOARD MEMORY (NO MEMORY INSTALLED)
- FLEKIBLE ADDRSSS CONFIGURATION
- INCLUDES SERIAL PORT, PARALLEL PORT
- OPTIONAL PIGGYBACK BOARD PERMITS EKPANSION TO 3 MB



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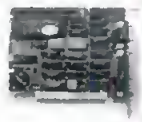

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- PARALLEL PRINTER PORT ADDRESSABLE AS LPTA OR LPTB (x378 OR x278)
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SHORT SLOT

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- FLEKIBLE STARTIND ADDRESS, ROUND OUT CONVENTIONAL MEMORY TO 640K & AOO EKTENDED MEMDRY ABOVE 1MB

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- OPTIONS INCLUOE THS ABILITY TO DIVIDE 1 LAROE DRIVE INTO 2 SMALLER, LOGICAL DRIVSS
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GET UP TO 50% MORE STORAGE SPACE ON YOUR HARD DISK

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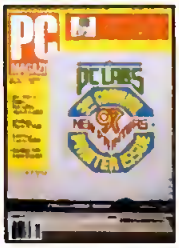

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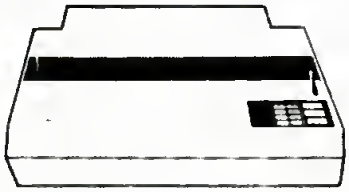

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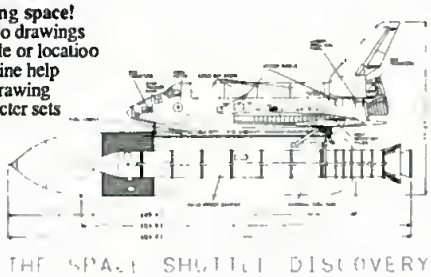

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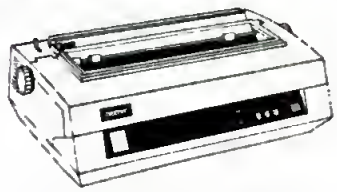

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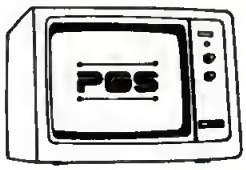

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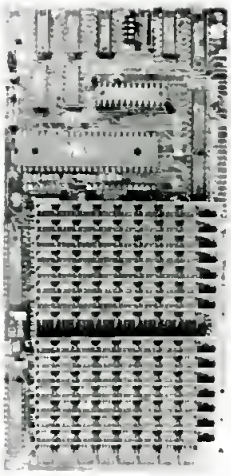

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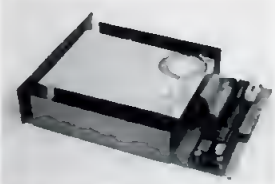

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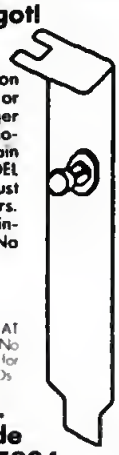

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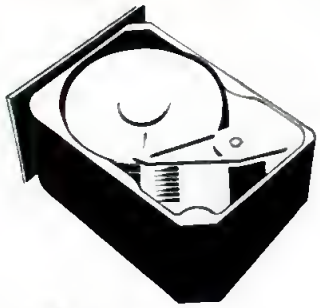

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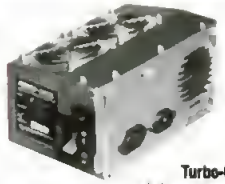

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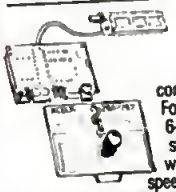

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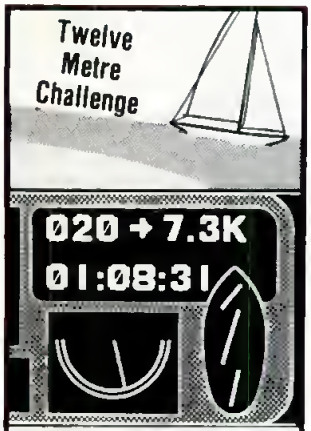

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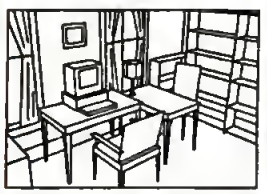

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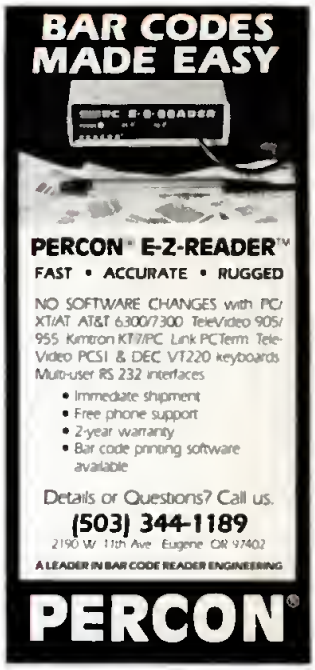

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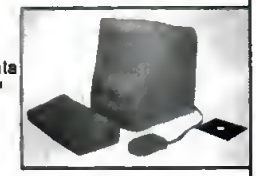

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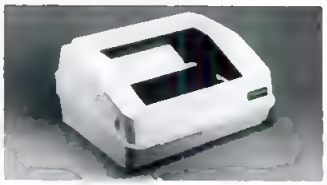

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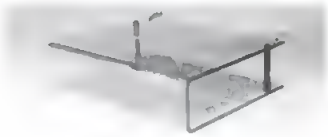

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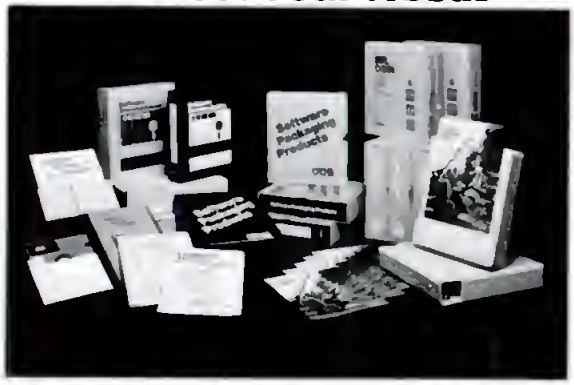

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a. ☐ Mainframe
b. ☐ Mini
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d. ☐ Printers/Plotters
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f. ☐ Terminals
g. ☐ Modems
h. ☐ Hard Disk/Tape Back-up
i. ☐ Add-in Boards
j. ☐ LANS
k. ☐ Micro-Mainframe Links

Software

l. ☐ Communications
m. ☐ Accounting
n. ☐ Spreadsheets/Financial Planners
o. ☐ Project Managers
p. ☐ Word Processors
q. ☐ Database Managers
r. ☐ Graphics

2. Your primary job function is (check one):

s. ☐ Administrative/General Management
t. ☐ MIS/DP, Communications Systems, Programming
u. ☐ Engineering/R&D
v. ☐ Finance/Accounting
w. ☐ Marketing/Sales

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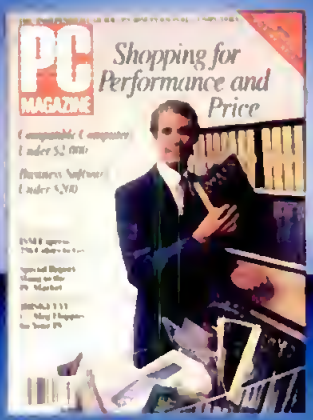

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COMING UP

ALTERNATE INPUT DEVICES Man does not compute by the keyboard alone, and the wide variety of alternate input devices we've assembled proves this to be true. Light pens, mice, tablets, touchscreens, trackballs, and even keyboards that incorporate tablets or trackballs fall under our scrutiny in this roundup of the many input options available.

DESKTOP ORGANIZERS Today's desktop organizers have surmounted the incompatibility problems that plagued earlier generations and are now more sophisticated than ever before. The host of products on the market will not only perform mathematical calculations and dial phone numbers, they'll also act as file managers, macro generators, and micro-to-host links. Even better, these RAM-resident utilities provide easy access to all these functions with just a few keystrokes. Merv Adrian and Tom Badgett review 14 of these space-saving utilities.

AT MULTIFUNCTION BOARDS If you're looking to increase the power and performance of your AT, you should check out the ten multifunction boards we've gathered for this review. These 16-bit boards provide the extra ports, memory, and other features you need to bring your AT up to speed.

NEC APC IV POWERMATE 1 AND 2 These two latest AT compatibles offer the efficient, high-quality engineering that PC users have come to expect of products from NEC.

PICTURE DATABASES This hot, new technology promises to put pictures as well as text into database records. We'll look at the products representative of the various turns the technology has taken—from databases made up only of pictures to systems that incorporate images into your *dBASE III* or other database files. One system even makes a database with both pictures and sound. We'll explore this exciting concept and tell you how well the systems actually perform—and more important, at what cost. PC

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AFTER HOURS

GAMES

COMPUTER SCRABBLE SPELLS THE WAY TO A TOUGH GAME

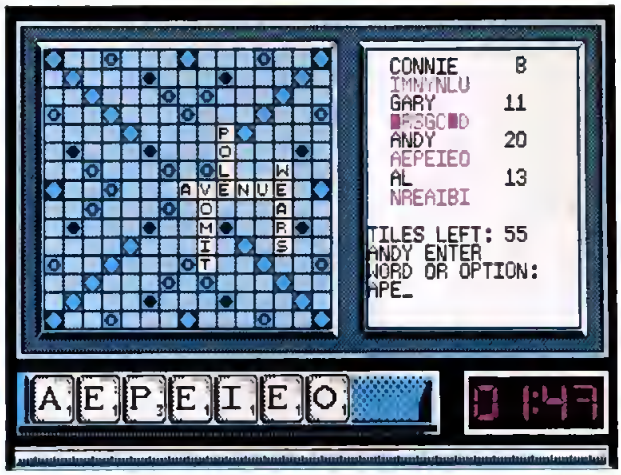
BY RUSEL DE MARIA

Traditional board games like chess, go, and Monopoly have already inspired successful computer adaptations. Now add Scrabble to the list. *Computer Scrabble*, from Electronic Arts, allows up to four players, human or computer, to compete in the traditional board game. Computer players participate at any of eight skill levels and draw their moves from a 20,000-word subset of the *Scrabble Player's Dictionary* (published by Pocket Books).

Game options include watching the computer think, seeing your opponents' racks, and playing against the clock (turns from 10 seconds to 10 minutes). You can also ask the computer for hints, rearrange your tiles, exchange tiles, pass a turn, and save games in progress.

Computer Scrobble displays a traditional Scrabble board. The default color scheme is rather dull, and Electronic Arts gives you no way to liven it up, but premium squares are clearly marked. During each turn you type a word, use the cursor keys to position it, then press D for down or A for across. Your score is calculated, and you can accept it, ask for a hint, or try another word. The computer will challenge words it does not recognize, but you can override the challenge. You can't challenge the computer, and there is no way to challenge a human player after the PC accepts a word.

Words like *zaeae*, *zoic*, and *inkier* are included in the dictionary, but some common words like *slave* are not. The computer will make strategic moves, like passing up *wiz* for 29 points in favor of *zig* for 14 and better board position.



Computer Scrabble's clock lets you impose a time limit for each move.

Computer Scrabble can provide a challenging game, and its dictionary and automatic scoring are useful enhancements. It may lack the intimacy of a good board game, but, on the other hand, you'll never have to hunt for another word lover to match wits with.

List Price: *Computer Scrabble*, $39.95. **Requires:** 256K RAM, CGA or Hercules Graphics Card. Copy protected. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (415) 571-7171.

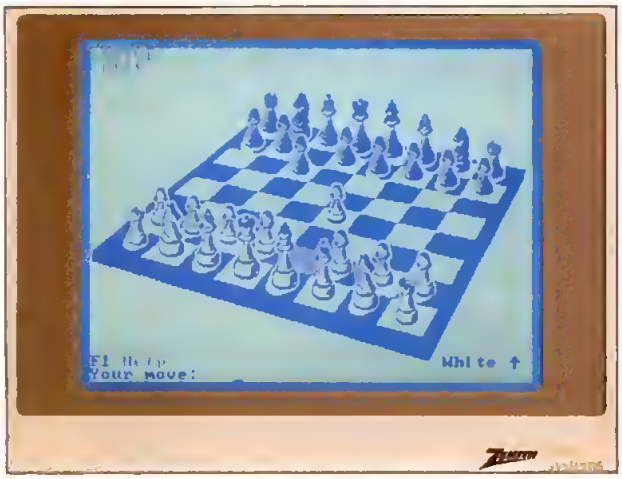
CIRCLE **689** ON READER SERVICE CARD

GAMES

LAPTOP CHESS: A WORTHY OPPONENT

BY MITT JONES

Now there's one more way to amuse yourself legally when you travel. *Laptop Chess*, by Mindscape, puts sophisticated graphics and power chess onto 3½-inch floppy disks. With 16 levels of play, *Laptop Chess* will accommodate the novice or pro. And if you tire of the program catching your every careless mistake, you can turn off your opponent in favor of a human partner.



The Laptop Chess 3-D display shown on the Zenith Z-181's large screen

Although dubbed laptop chess for marketing purposes, the program will run fine on any PC with a 3½-inch disk, including the Personal System/2 computers.

It works on any laptop with CGA-compatible graphics.

For portable play, you'll need the large, backlit screen of the Zenith Z-181 Portable PC to take advantage of *Laptop Chess*'s nice-for-a-laptop 3-D display: the IBM PC Convertible's small screen cramped the 3-D display, prompting me to toggle to *Laptop*'s also-impressive 2-D display.

Otherwise nicely designed, *Laptop Chess* has two major flaws. First, there is no way to display captured pieces, though you can display or print a game record in algebraic notation. Second, you can move pieces using the cursor keys, but finding the cursor can be a challenge. *Laptop* places the inconspicuous cursor on the square from which you began your previous move; unless you've got a good memory, you're never quite sure where the cursor will end up.

To test *Laptop*'s chess-playing ability, I pitted it against *Chessmaster 2000*, arguably the king of the PC-chess pack. I gave each product about 3 minutes per move. *Laptop Chess* certainly didn't leave the field blushing, but *Chessmaster* had a slight edge, winning two out of three games.

Despite a few problems, *Laptop Chess* is a more-than-worthy opponent and a lot of fun. It should keep your mind off the landing—and the food—during long, cross-country flights.

List Price: *Laptop Chess*, $39.95. **Requires:** 256K RAM, 3½-inch floppy disk drive. Copy protected. Mindscape Inc., 3444 Dundee Rd., Northbrook, IL 60062.

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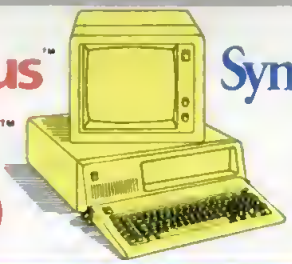

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AFTER HOURS

SPORTS

RUNNINGWARE: A TRAINING PARTNER FOR THE SERIOUS COMPETITOR

BY GUS VENDITTO

Let's see. Sixty-five dollars for a pair of New Balance shock-absorbing running shoes. One hundred and thirty-nine dollars for a Gore-Tex all-weather running suit. A few dollars more for sundry necessities, like a headband, a sweatband, and some Ben-Gay.

That should be enough of an investment to get you up an hour earlier every day, pounding the asphalt for a few miles of fitness. If it's all crumpled in a closet corner, gathering mildew, maybe another $80 investment will help.

Runningware with Alberto Salazar, from Sportsware, promises to make you a smarter runner. Lazy, twice-a-month joggers can use the program's tips on training to keep them on the track, free of injuries. Serious, competition-minded runners could find the training partner that they lost when they left school.

One part of *Runningware* is pretty much a series of carefully designed log books that tote workout results and race performances. It will analyze the results you post in various ways, always keeping an index to your performance called the VO2-MAX, which is a number between 20 and 90 that is based on the amount of oxygen you can process per minute per kilogram of body weight. It's supposed to show you your level of aerobic fitness.

If you're the type who likes to look at your performance in numbers, you'll be in jog heaven. You can sort race results chronologically, by distance, pace, or by VO2-MAX. You can graph performances by pulse rate, calories expended, or 12 other categories. You can even keep separate records for up to four pairs of running shoes.

Runningware mixes advice with a series of training logs.

Runners who are just trying to keep in shape can keep logs of their workout, getting an idea of whether they're improving or not. Attention to heart rate statistics will give them the greatest indication of how running is affecting their health.

Serious runners, with their organized races on their schedules, can keep separate records of race times. Performances in miles and kilometers are kept organized by the progam. Splits and race day conditions can be tracked. The program will flag a "Personal Best" out of your logged performances.

All of this could be done with a spreadsheet and some macro programming. What *Runningware* has going for it is serious, educated advice provided on three separate levels.

One level covers the fundamentals of training, explaining for novices the terminology and basic practices used by most track coaches.

Another level, the physiology of running, gives about 250 words of sound advice on 28 different topics, ranging from length of stride to the anaerobic threshold. It is derived from the theories of William Bowerman, onetime head coach of the U.S. Olympic Track Team and coach of three NCAA track-and-field championship teams. There are some familiar homilies but also some fascinating discussions of running problems. I, for one, never knew the difference between a stitch on the left side (eating too soon before running) and the right side (dehydration or illness); maybe some track coach told me years ago and I just wasn't paying attention. The only medical advice I recall from my track coach was to "jog on it."

World-class distance runner Alberto Salazar writes, in his own words, on about 28 topics. How valuable this section is depends on whether you care about knowing how much Salazar sleeps each night (7½ hours) and why he always wears socks when he runs (to prevent blisters). It's advice on the level of an in-depth running journal interview.

School-age athletes should avoid taking the program too seriously; tell the coach you think you should do wind sprints today instead of distance running because your PC told you so and you'll find yourself doing 50 sit-ups after practice.

Mature runners who have an eye on winning more than a T-shirt at the next 10K run will find that *Runningware* can really help.

List Price: *Runningware with Alberto Salazar*, $79.95. **Requires:** 256K RAM, DOS 2.0 or later. Not copy protected. Sportsware, 2533 Pimlico, West Linn, OR 97068; (503) 650-0605.

CIRCLE 690 ON READER SERVICE CARD

Tips from a Winner

Alberto Salazar, two-time winner of the New York Marathon and current holder of the United States 5K and 10K records, is working his way back into competitive form after missing the past 3 years with a knee injury. At the age of 28, he told me, he feels his best years are ahead of him.

Because *Runningware*'s structure of workout logs and training tips are based on the University of Oregon's track program—under which he trained—Salazar said he was happy to lend his name and experiences to the PC adaptation.

He wrote his tips for *Runningware* after the program's training and race logs were finalized. "I looked at the program and wrote tips that I felt would explain to the user why these workouts are going to help. . . . I've seen the Oregon Program work for hundreds of others and it's worked for me, so I was happy to put my name on it."

Salazar said the program is "for the person who doesn't have a coach—the program can be their coach."—Gus Venditto

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AFTER HOURS

FINE DINING

ANTHONY DIAS BLUE WINES ON DISK: WINE SELECTOR NEEDS MORE TIME

BY JOHN C. DVORAK

Anthony Dias Blue Wines on Disk, from Paperback Software, sounds like a 33⅓ rpm recording of a guy who complains all the time. Actually, it's a large database of wine information packaged in a so-called expert system that is awkward and slow.

Blue, a notorious restaurant reviewer in New York and a wine writer for a number of magazines, keeps tons of tasting notes in *dBASE III* files. The most up-to-date and universal notes were moved over to this disk and turned into a wine selector. The idea is to help you pick a wine to go with just about any meal.

A Taste of Vinegar

Thank goodness you don't have to use it often. The expert system is plagued with awkward, unnatural commands. For example, at the bottom of one screen it says "Enter to Go On—END to Complete." It doesn't work that way. What you really have to do to continue is hit the Return key, then the End key. This software relies on the End key as the Enter key. It's an uncomfortable and bothersome interface done only to accommodate multiple selections on a screen menu. The Enter key serves mostly as a key to tag selections. There are better ways to do it.

Another irritant is the inability to do any meaningful sorts, something one would expect from any database software, let alone one fronted by an expert system (especially with 80K of leftover space on the disk). If you want, for example, to list all the cabernets by quality, you can't do it. It lists in the order found in the database and that's that. Since the wine files appear to be standard *dBASE* files, you could figure out the fields, export the data, and use another program to extract the information.

A Bunch of Grapes

But Blue's large database makes the program worthwhile. It's excellent. My only complaint was his exclusion of common and interesting varietals such as Ruby Cabernet and Carignan (not to mention the hybrid grapes of the East Coast) while highlighting the screwball Chancellor grape, which nobody has ever heard of. To look at his grape list you'd think that the Chancellor grape was as common as Zinfandel, until you find he lists only one lone Finger Lakes winery that makes wine from it. Obviously Blue liked the stuff.

Wines on Disk *suggests a wine based on your price range and main course.*

The gimmick of the software is that you can describe a meal and this expert system will choose a wine for you. It does the job adequately but, let's face reality, it doesn't take a complex and consequently sluggish expert system to choose wine. My advice is to buy a book on wines and read about what foods go with what wines. It's something everyone should know.

Anyway, Blue has uncovered more than a few "finds," and since wine is so expensive, this program will guide you in ways that will surely save you enough dough to pay for the software. For this reason I can recommend it.

List Price: *Anthony Dias Blue Wines On Disk*, $39.95. Copy protected. Paperback Software, 2830 Ninth St., Berkeley, CA 94710; (415) 644-2116.

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After Hours will show you uses for your PC that will help you get more out of your leisure pursuits than simply sharpening your trigger finger.

AFTER HOURS INDEX

ANTHONY DIAS BLUE WINES ON DISK
Making the right choice

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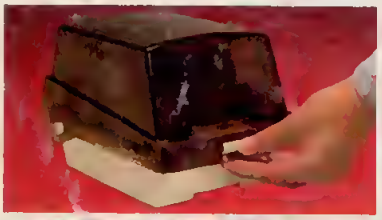

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